

Implicit vs. Explicit Processes of Motivation and Affect Regulation in Unconsciously and Consciously Critical Situations in Sports

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ABSTRACT

Dual-process models distinguish implicit and explicit ways of information processing (Strack & Deutsch, 2004). *Implicit* processes are based on associative affective networks and operate fast and unconsciously. *Explicit* processing is a cognitive, usually slow, deliberate, and conscious way of decision-making. Dual-process models of motivation propose that *implicit motives* predict long-term behavior and *explicit motives* predict deliberate decisions (McClelland, Koestner, & Weinberger, 1989). Up-regulation of *positive affect* and down-regulation of *negative affect* activate implicit cognitive systems while regulation in the opposite direction triggers explicit information processing (J. Kuhl, 2000a).

Within three field studies it is investigated whether implicit vs. explicit motivational processes are of discriminant validity for professional athletic behavior in *unconsciously* vs. *consciously* critical situations. In study one and two, tennis ($N = 60$) and basketball professionals' ($N = 56$) abilities to regulate positive and negative affect (ACS-90; J. Kuhl, 1994) are assessed. In study three ($N = 86$) the additional measures of implicit (OMT; J. Kuhl & Scheffer, 1999) and explicit motives (PRF; D. N. Jackson, 1999) as well as conscious self-regulation (VCQ; J. Kuhl & Fuhrmann, 1998) are used. Study one proposes that explicit processing (low positive affect regulation) supports performance in *objectively* critical situations (tie breaks) in tennis. However, in *consciously* critical situations no advantage for explicit processing athletes could be found. In study two implicitly processing (high negative affect regulation) basketball players perform better in *objectively* critical games. In the final study racquet sportsmen who process explicitly perform better in *consciously* critical situations. In contrast, in *unconsciously* critical situations athletes with high implicit motives gain better results. Findings are discussed from the perspective of task specificity in different kinds of sport, degree of awareness of critical situations, and athletes' individual differences.

ZUSAMMENFASSUNG

Duale Prozessmodelle unterscheiden implizite und explizite Formen der Informationsverarbeitung (Strack & Deutsch, 2004). *Implizite* Verarbeitung erfolgt schnell und unbewusst und basiert auf affektiv-assoziativen Netzwerken. *Explizite* Verarbeitung geschieht überlegt und langsam und beinhaltet bewusste, kognitive Entscheidungsprozesse. In dualen Prozessmodellen der Motivation sagen *implizite Motive* langfristiges Verhalten und *explizite Motive* bewusste Entscheidungen vorher (McClelland, et al., 1989). Hoher *positiver Affekt* sowie geringer *negativer Affekt* aktivieren implizite kognitive Systeme während eine entgegen gesetzte Ausprägung explizite Informationsverarbeitung bahnt (J. Kuhl, 2000a).

Drei Feldstudien untersuchen die diskriminante Validität impliziter vs. expliziter motivationaler Prozesse für das Verhalten in *unbewussten* vs. *bewussten* kritischen Situationen im Hochleistungssport. In Studie 1 und 2 wird bei Tennis- ($N = 60$) und Basketballspielern ($N = 56$) die Fähigkeit erhoben, positiven und negativen Affekt zu regulieren (ACS-90; J. Kuhl, 1994). In Studie 3 ($N = 86$) werden zusätzlich implizite (OMT; J. Kuhl & Scheffer, 1999) und explizite Motive (PRF; D. N. Jackson, 1999) sowie die Fähigkeit zur bewussten Selbstregulation (VCQ; J. Kuhl & Fuhrmann, 1998) gemessen.

In Studie 1 sagen explizite Formen der Verarbeitung (niedrige positive Affektregulation) die Tennisleistung in *objektiv* kritischen (wie Tie Breaks) aber nicht in bewusst kritischen Situationen vorher. In Studie 2 führt implizite Verarbeitung (hohe negative Affektregulation) zu besseren Basketballleistungen in *objektiv* kritischen Spielen. In Studie 3 unterstützt explizite Verarbeitung Leistungen in *bewusst* kritischen Situationen im Rückschlagsport. In *unbewusst* kritischen Situationen erzielen dagegen Sportler mit ausgeprägten impliziten Motiven bessere Ergebnisse. Die Befunde werden hinsichtlich der Aufgabenspezifität in verschiedenen Sportarten, dem Grad der Bewusstheit kritischer Situationen sowie der Persönlichkeitsunterschiede von Athleten diskutiert.

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INTRODUCTION

In high performance sports like tennis, badminton, table tennis, or basketball, spectators oftentimes have the impression that athletes might achieve more if they were better able to motivate themselves or use their will to compensate performance slumps. Especially in racquet sports like tennis or table tennis players frequently seem to give up effort to fight back as soon as they are well down in a set. Yet other players are just overcharged by the right way to enhance their performance by means of self-motivation, will activation, or regulation of their emotions (affects). This sometimes may be due to players' inability to consciously and by will change the mental states they are in.

Within the past two decades several elaborate models of self-regulation were put forward that try to integrate findings on motivation and will (volition) from an information processing perspective (e.g., Carver & Scheier, 1998; J. Kuhl, 2000a). Up to date these kinds of models have been rarely applied to sport settings (e.g., Elbe, Szymanski, & Beckmann, 2005). Although more integrated models may be of additional predictive value for athletic performance, past research focused only on single aspects from a more explicit perspective on motivation and volition (e.g., Duda & Nicholls, 1992). Yet sport psychologists are interested in what best predicts athletic performance. This endeavor is shared with social psychologists who seek to predict behavior from different psychological constructs (Strack, Deutsch, & Krieglmeyer, 2009). In the domain of sport psychology, the behavior to be predicted is sports performance. However, many times constructs measured in social and sport psychology are of predictive value for past behavior but not for future performances (Gigerenzer, 2007) or may be limited to laboratory settings and lack ecological validity (Raab, 2005a). Within social psychology "*the intelligence of the unconscious*" (Gigerenzer,

2007) could be illustrated for several sports-related phenomena. For example, typical sport skills like a free throw in basketball or a catch in baseball are much too complex to be consciously processed by the brain. Nobody could possibly voluntarily and consciously activate all the single muscles involved in these movements, calculate the right angle and speed of the ball, or the distance to the goal in the fractions of a second that are available to prepare these movements. Such skills need automaticity and intuition to be implemented successfully (p. 9-10). Implicit decision making in sports also points to the advantage of the unconscious (e.g., Raab, 2005b). Implicit learners are able to make higher quality decisions in low complexity situations. That means whenever implicit learners have to make easy tactical decisions they outperform explicit learners. Another example is the growing body of research that supports the idea that pursuing a goal could be an implicit, non-conscious process as well (e.g., a summary by Dijksterhuis & Aarts, 2010). Aarts and colleagues could show that goals, once set, were also pursued more often and shielded against competing goals when words representing that goal were presented subliminally (Aarts, Custers, & Holland, 2007). Although all these examples strongly relate to sport settings only few attempts have been made to utilize the power of the unconscious for the sports domain, especially in the area of motivation and volition.

Furthermore, in motivational psychology recent research has been focusing on the differential validity of implicit and explicit motives. When information is processed explicitly stimuli will be consciously perceived and deliberate decisions are made. However, when situations put a lot of pressure on athletes (e.g. by time or score) information processing capacity of explicit systems are carried to end. By then actions will be rather controlled by implicit processes. These automatisms and intuitive behavior are supported by activation of respective affective states (McClelland, et al., 1989; Strack & Deutsch, 2004). For example, it could be shown that performance in a vigilance task can be predicted by implicit motives. In contrast, the decision to continue

working on this task is predicted by explicit motives (Brunstein & Hoyer, 2002). Similarly, explicit motives determine what kind of work project a person decides on. But the intensity with which the person works on this project is rather affected by their implicit motives (Dahme, Junnickel, & Rathje, 1993). Until recently, no similar effort has been made in sport psychology to investigate the discriminant validity of implicit and explicit motivational systems. For example, Schüller (2010) could show that incongruence of implicit and explicit motives has a detrimental effect on flow experience in athletes only if the situation involved offers achievement incentives. Furthermore, Schultheiss and Rhode (2002) were able to show that implicit motives (and not explicit motives) predict performances in a contest situation. Besides this recent research in the domain of sport psychology, studies which utilized direct motivation measures (like the Thematic Apperception Test) are dated back to the 1970s (Gabler, 1972; Sorrentino & Sheppard, 1978; Steiner, 1976). The reason for this was given by Elbe and colleagues who pointed at dissatisfying psychometric properties for measures for implicit motives (Elbe, Wenhold, & Müller, 2005). However, improvements have been made in this area leading to an increased number of studies on the discriminant predictive value of implicit and explicit motives at least in social psychology. Yet in the field of sport psychology, a lot of effort was put into the development of a variety of measures of different aspects of achievement motivation. To name a few, questionnaires like the *Task and Ego Orientation in Sport Questionnaire* (TEOSQ; Duda, 1989; Duda & Nicholls, 1989), the *Sport Orientation Questionnaire* (SOQ; Gill & Deeter, 1988), or the *Sport Motivation Scale* (SMS; Pelletier, et al., 1995) became popular, have been translated into many languages, and have been guiding research on performance links.

In high performance sports, research by sport psychologists may especially help athletes in situations in which they need a strong mind to control behavior. These critical situations have not been illuminated yet regarding in what way conscious awareness of situation criticality may affect athletes' performance. Some authors see

conscious awareness of the criticality of a situation as a precondition (*subjectively critical*; Knisel, 2003; Lazarus & Folkman, 1984) others define critical situations using competition scores and time without actual knowledge of an athlete's awareness of the criticality of a situation (*objectively critical*; Bar-Eli & Tenenbaum, 1989). Within the present research the criticality of a situation is carefully dissociated with respect to the level of conscious awareness to the athlete. The assumption behind this is that implicit (unconscious) mental processes may be better predictors of behavior in unconsciously critical situations while explicit mental processes (that may be consciously aware) better predict behavior in critical situations the athlete is consciously aware of. Respective effects could be shown in a laboratory setting in which the number of distracting thoughts during reading a text was assessed. Participants whose information processing in general was implicit had less distracting thoughts compared to explicit processing individuals not consciously aware of negative affect. However, when participants were aware of the negative affect those who usually process explicitly were less distracted than implicit processing individuals (Baumann & Kuhl, 2002). Consequently, when awareness of criticality fits individual information processing preferences athletes' performance should benefit.

Now, findings from social psychology research mostly originated from laboratory settings. The aim of the present research was not to replicate findings in a laboratory setting but with more sports-like experiments. The present work tries to apply research findings to real life competitive sports situations. Although in this way ecological validity can be maximized, conditions of course show little control and are highly vulnerable to impacts from competitive settings. Yet the present research is exploratory in many respects. It should be seen as a first step to investigate whether concepts of implicit and explicit motivational processes, affect regulation, and (un)consciously critical situations can be of additional predictive value for the domain of sport psychology. It still needs to be examined whether findings presented in this work can be replicated in

more controlled laboratory settings that also use sports-related tasks. However, findings presented here are indicative of that such a future endeavor may be very fruitful.

The first part of the theoretical framework presented in this research report deals with dual-process models and how they provide the basic assumptions for the dissociation between implicit and explicit processes. Following these models from social psychology two dual-process models of motivation are presented that include these basic theoretical assumptions. The information processing model of implicit and explicit motives introduces the concept of two interdependent motivational systems that can be adopted to the three basic needs of achievement, affiliation, and power (McClelland, et al., 1989; Schultheiss, 2001). Further, the theory of personality systems interactions provides explanations of the interaction of implicit and explicit motives, volitional processes, and how goal pursuit is modulated by positive and negative affect (J. Kuhl, 2000a). After this chapter the concept of criticality is introduced with reference to assumptions on stress and arousal in the domain of athletic performance (Bar-Eli & Tenenbaum, 1989; Landers & Arent, 2006). Concluding the theoretical framework explanations on the concept of unconsciousness, unconscious goal pursuit, and unconscious stress are given (Bargh & Morsella, 2008; Hassin, Aarts, Eitam, Custers, & Kleimann, 2009).

Following the theoretical framework three empirical studies are presented. In study one, tennis players' performance in *subjective* critical situations of real life competition as a function of their ability to regulate positive and negative affect (implicit vs. explicit) is examined. In study two, the performance of basketball players in the *objectively* critical situations of real competition is analyzed. Again, athletes' ability to regulate positive and negative affect (implicit vs. explicit) is of central interest. Consequently, in study three regulation of positive and negative affect in real life sport situations is focused on. This time only racquet players (tennis, table tennis, badminton) are examined. However, in the third study both *subjectively and objectively* critical situa-

tions are assessed. That means athletes were either consciously aware or not aware (unconscious) of a critical situation. Additionally, athletes' basic implicit and explicit motives are considered in order to predict competitive performance.

The findings presented in this work should encourage researchers in the field of sport psychology to focus on implicit motivational processes in order to be able to make (better) predictions for real life sports performance. Moreover, measures of implicit motivational processes may be a better means to predict long-term athletic behavior and offer additional insight to the personality of successful professional athletes.

Dual-System Models in Social Psychology

Varying dual-process models have been proposed in social psychology for over twenty years (e.g. Chaiken & Trope, 1999; McClelland, McNaughton, & O'Reilly, 1995; Schacter & Tulving, 1994; Sherry & Schacter, 1987). Many of the models are limited to special areas of social psychology like social judgment (Martin, Seta, & Crelia, 1990), reasoning and problem solving (Donovan & Epstein, 1997; Epstein, 1991; Sloman, 1996), attitude formation and access (Fazio, 1986; Petty & Cacioppo, 1986), stereotyping (Devine, 1989; Greenwald & Banaji, 1995), goal pursuit (Carver & Scheier, 2000; J. Kuhl, 2000a), habits (Aarts & Dijksterhuis, 2000; Dijksterhaus & Bargh, 2001), and needs (Aarts, Dijksterhuis, & De Vries, 2001; Brunstein, 2010). Although authors use different notations for the two modes within their process models, common to all models is that they refer to *automatic* processes on the one hand, and *controlled* processes on the other. For example, Greenwald and Banaji (1995) make a distinction between implicit and explicit forms of cognition. To their mind processes can be called implicit when a person's thought or behavior is influenced without conscious awareness. Thus, this influence could not be detected by direct measures like self-reports. In contrast,

processes are explicit when a person is consciously aware of the influence, or thought is even required for the mental representation to have impact. Bargh (1994) renders the difference between implicit and explicit more precisely: automatic (implicit) and controlled (explicit) processes may be differentiated along the four features awareness, intention, efficiency, and control. *Awareness* – or rather *unawareness* – refers to the fact that someone might be unable to perceive a subliminal stimulus, might be unaware of the influence of a stimulus, or might misattribute the impact of a stimulus on thought and behavior (see also Nisbett & Wilson, 1977). *Intention* refers to whether someone is in control of the initiation of a process. *Efficiency* denotes that a process is effortless and performed easily. *Control* means someone is able to stop a process (Bargh, 1994). Accordingly, explicit processes are more aware, intentional, and consciously controlled but at the same time less efficient than implicit processes. The term unconsciousness will be further discussed below (see chapter on unconsciousness). Since in motivational psychology the terms implicit and explicit are commonly used (e.g. Baumann, Kaschel, & Kuhl, 2005; Schultheiss, 2001) in the present work Greenwald and Banaji's notation is followed. Thus, automatic non-conscious processes are referred to as implicit, controlled conscious processes are called explicit.

Within social psychology researchers use the dissociative value of direct (explicit processes) and indirect measures (implicit processes) in the areas of social judgments (L. Winter & Uleman, 1984), attitudes (Fazio, Sanbonmatsu, & Powell, 1986; Greenwald, McGhee, & Schwartz, 1998), self-esteem (Koole, Dijksterhuis, & van Knippenberg, 2001), or stereotype (Dovidio, Kawakami, Johnson, Johnson, & Howard, 1997). It could be shown that between measures of direct and indirect processes only weak relations exist, for example for the concepts of stereotype (Lowery, Hardin, & Sinclair, 2001; Rudman, Ashmore, & Gary, 2001) or attitudes (Wittenbrink, Judd, & Park, 2001).

Finally, convincing arguments for comprehensive models of basic dual-systems have been put forward (Smith & DeCoster, 2000; Strack & Deutsch, 2004). Within these dual-system models a small number of common features serve as the theoretical basis. Now this basis accounts for many single phenomena from human decision and behavior, which had been predicted by many different theoretical models in the past (Strack & Deutsch, 2004). While Smith and DeCoster deal more with human judgment and decision Strack and Deutsch focus on how dual-process models help predict behavior.

Associate vs. Rule-Based Processing Modes

Within the dual-system model of Smith and DeCoster (2000) two modes of functioning determine how information is processed. These two processing modes draw on basic underlying memory systems: the slow- and the fast-learning system. A *memory system* in this context is perceived as a set of acquisition, retention, and retrieval mechanisms which use fundamentally different rules of operation, not only information storage (Sherry & Schacter, 1987). This is in line with several other theorists who put forward different memory systems (e.g. J. Kuhl, 2000a; McClelland, et al., 1995; Schacter & Tulving, 1994).

The *slow-learning system* is essential because humans need to rely on long-term stable knowledge that builds on repeated experiences of typical properties of the environment (schemas) (Rumelhart, Smolensky, McClelland, & Hinton, 1986). It is a network of overlapping systems involved in sensory, perceptual, and motor output processes (Smith & DeCoster, 2000). The slow-learning system does not depend on conscious awareness or attention. It categorizes new information, is able to fill in unobserved details, and focuses on what is expected and typical.

In contrast, the *fast-learning system* helps a person in rapid learning of new information in order to remember objects only after single exposure (DeCoster, Banner, Smith, & Semin, 2006). The system works consciously and supports the recollection of different contextual aspects of an information explicitly (Wiles & Humphreys, 1993). It focuses on the novel, unexpected and interesting aspects of an object. Information repeatedly presented to the fast-learning system will be shifted into the slow-learning system through the process of *consolidation* which might take weeks to years (Smith & DeCoster, 2000).

Associative Processing Mode. In everyday life situations, two different processing modes determine how judgments and decisions are made. They are based on the two learning systems described above. The *associative processing mode*, also known as automatic processing, draws on the slow-learning system and works as a pattern-completion mechanism (DeCoster, et al., 2006). Knowledge can be attained from a large number of experiences (many repetitions) and take a long time to be built (two weeks up to years). This benefits the stability of (social) knowledge. An example could be a badminton player who learned over the course of his career to return to center point of the court after he played the ball close to the net or in the back court. Since associative processing operates preconsciously it enables automatic, quick, efficient, and effortless responses to stimuli. As such, different characteristics of an object as well as affective reactions previously experienced are readily activated even if only a cue of an object is presented to the individual. These cues may well be superficial or seem irrelevant. However, they represent similarities that help categorize objects (Smith & DeCoster, 2000).

Rule-Based Processing Mode. The *rule-based processing mode* is also called conscious processing. It uses symbolically represented knowledge and rests on human linguistic abilities. For this reason the rule-based processing mode connects to both memory systems (DeCoster, et al., 2006). Rules will be stored in fast-learning memory

when a person was only exposed one or two times to the rule (frequency). Rule-based processing is a sequential, slow and analytical process that uses only a certain specific detail of an object. Consequently, only one rule can explicitly be used at a time. In contrast, associative processing takes into account the overall similarities of objects. Rule-based processing only takes over when people have a strong motivation, the capacity to process information with conscious attention, and are not distracted (DeCoster, et al., 2006). Thus if information is too complex for cognitive *capacity* (processing time, attentional resources) rule-based processing will be disabled and associative processing will take over. Furthermore, in rule-based processing access to knowledge is gained consciously, and intentionally, and it needs effort. That means a person needs to be *motivated* to process knowledge based on rules. Finally, rules are learned through socially accepted symbols, which are most commonly language.

Besides capacity and motivation, mood and specificity of stimuli and targets were suggested as moderators between the two processing modes (Smith & DeCoster, 2000). Positive mood supports associative processing while negative mood fosters rule-based processes (e.g. J. Kuhl, 2000a). It appears that more detailed specific stimuli are cues for associative processes while more general abstract stimuli trigger rule-based processing (Epstein, 1991).

For Smith and DeCoster (2000), interactions between the two processing modes are limited to the repeated use of rule-based processing and to the monitoring of past behavior. For example, for his tennis service an athlete might recall that he needs to hit the ball 20 cm in front of his body over and over again. By doing so repeatedly the rule-based processing becomes an associative process. Consequently, in the future he will show this behavior automatically. This reflects a shift from rule-based to associative processing. In contrast, a shift from associative to rule-based processing might be realized through envisioning past behavior. This way a rule may be formed from analyzing what kind of playing behavior someone showed in the past: For exam-

ple, hitting many aces throughout a tennis season may result in a rule that someone has a good first service.

The Reflective-Impulsive Model

In contrast to Smith and DeCosta (2000), Strack and Deutsch (2004) proposed a model that explains behavior as a product of two parallel mental systems with distinct operating principles that do interact at different stages of processing (cf. Metcalfe & Mischel, 1999). This model is called the *Reflective Impulsive Model* (RIM). It is described at a mental level but corresponds with models proposed by neuroscientists (e.g. Bechara, 2005).

Impulsive System. Within the RIM, the *impulsive system* (IS) is assumed to be permanently active. That is why behavior is a result of associative links between perceptual inputs and behavioral schemata (see Figure 1.1; Strack & Deutsch, 2004). In this regard it resembles James's (1890) ideomotor principle in the way it elicits behavior without any intention or goal. Behavioral activation may also occur when concepts are only indirectly associated with a behavioral schema. Findings of reduced walking speed of persons exposed to a stereotype of the elderly are an example for this principle (Bargh, Chen, & Burrows, 1996). Similarly, athletes will show automatic behavior like responding to an opponent's forehand cross with a forehand cross time and time again, although a different tactical option might be more appropriate. As a typical feature of associative networks, links between elements are established and strengthened by *frequency* and *recency*. That means when stimuli are presented in temporal or spatial proximity associative links are created or strengthened (Strack, et al., 2009). Activation is executed by either one element that is strongly associated or by a joint activation of several elements at the same time. Further, positive vs. negative *affect* (see also J. Kuhl, 2000a) and *valence* support the activation of associative links. In other words,

positive affect (or positive stimuli) may facilitate approach behavior while negative affect (or negative stimuli) may facilitate avoidance behavior (fight or flight; Strack, et al., 2009). These links are bidirectional. Operations of the impulsive system require little effort and little cognitive capacity. At proper preactivation, exposure to an appropriate stimulus may quickly lead to the corresponding behavior (parallel processing). Consequently, the impulsive system is capable of fast and automatic adjustments to the environment (Strack, et al., 2009). This way competitive behavior in sports is supposed to be guided by the impulsive system if and when an athlete is under pressure in critical situations. The downside of these quick associations is that the stable links are created slowly and need repetition. Once established, they are rigid and resistant to change (Devine, Plant, & Buswell, 2000). In that regard, the impulsive system can on the whole be considered alike to a long-term memory (Strack & Deutsch, 2004).

Reflective System. Behavior initiated by the *reflective system* (RS) is consciously intended and the result of a decision process. Additionally, the *value* and *expectancy* of the consequences of an action are considered (see also Figure 1.2). Activation of the reflective system is dependent on the cognitive capacity that is available. Because only a limited amount of information can be processed at a time the reflective system in many regards works like a temporary storage (Strack & Deutsch, 2004). Consequently, extreme levels of arousal will cause distractions and be detrimental to the quality or efficiency of behavior. This can be important in critical situations in sports where pressure can be high due to close scores or elapsing time. In these situations, reflective operations may be impaired. Reflective operations are *sylogistic* i.e. perceived information and its characteristics are evaluated and categorized. As such, the reflective system allows logic transformation like negations of a concept or it may draw inferences from perception. Thus, elements in the reflective system are connected through semantic relations rather than through associative links like in the impulsive system (Strack & Deutsch, 2004). This kind of processing includes reasoning, plan-

ning, and intending, which lead to longer and slower processing time (sequential processing) compared to the impulsive system (parallel processing; see Figure 1.1). Consequently, as long as intentions are formed behavior cannot be executed (Strack & Deutsch, 2004). In the same way, core affects present in the impulsive system are transformed into feelings or emotions within the reflective system so that deliberate emotions are available rather than impulsive affects as in the impulsive system. Taken together the reflective system assigns a category to an object perceived, evaluates the information, and provides a behavioral decision. Finally, an intention is formed that leads to actual execution of behavior.

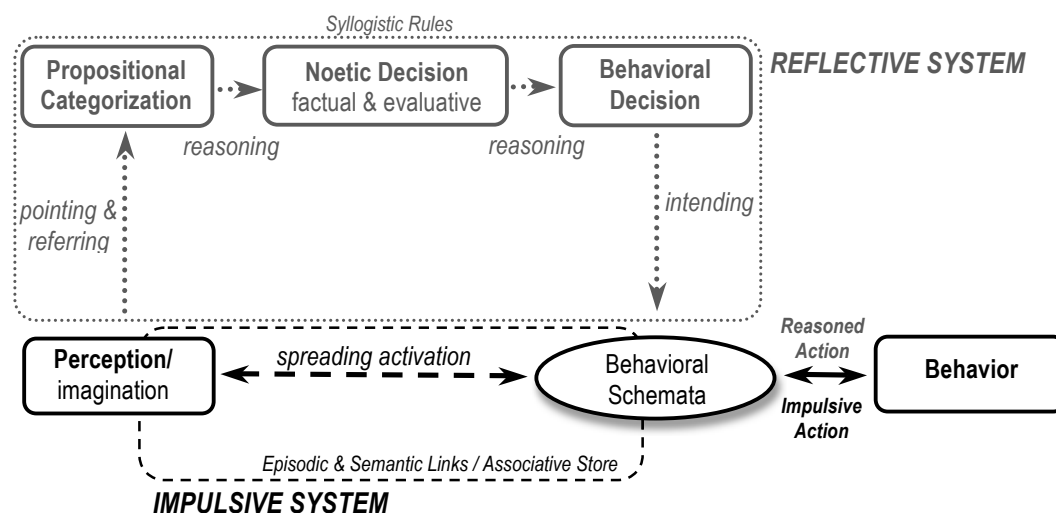


Figure 1.1 Reflective (dotted lines) and impulsive processes (dashed lines) within the reflective-impulsive model (RIM) (adopted from Strack & Deutsch, 2004)

Strack and Deutsch (2004, p. 223) assume that both systems operate in parallel and interactions are possible. Because of limited working memory capacity the reflective system needs an informational basis on which to generate decisions. The long-term storage of the impulsive system with its unlimited capacity provides the information for the reflective system. Categorization procedures and inferences can generally

only be performed by the reflective system if a respective schema is already represented in the impulsive system. Activation of a certain schema in the impulsive system is usually prompted by the incoming stimulus and will thus activate both information from the impulsive and the reflective system. It seems obvious that reflective operations on the one hand depend on the amount of exposures to and the newness of a stimulus (*frequency* and *recency*), and on the other hand on the number of times certain contents have been thought about in the reflective system. Therefore, the interactive processing of a certain content is biased by the frequency and recency from the IS as well as prior use of the information in the RS – *anchoring heuristic* (Mussweiler & Strack, 1999). It should be noted here that the final pathway from behavioral schemata to actual behavior is shared by both systems (see Figure 1.1). Behavioral schemata are basically habits that can either be activated by associations from the impulsive system or syllogistic rules from the reflective system (Aarts & Dijksterhuis, 2000; Strack & Deutsch, 2004). Synergistic interplay of both systems is accompanied with a feeling of fluency (Winkielman & Cacioppo, 2001) which in sports may result in phenomena like flow (Schüler, 2010). However, if activated schemata by both systems show antagonistic tendencies the impulsive system will guide behavior whenever arousal levels are extreme.

The reflective impulsive model also integrates assumptions about *motivational orientations*. According to Strack and Deutsch (2004, p. 231), persons with *approach orientation* tend to reduce the distance to an object while persons with avoidance orientation tend to increase this distance. Approach and avoidance orientations interact with (1) the perception of approach or avoidance, (2) the experience of positive and negative affect (see section on personality system interactions), (3) the processing of positive or negative information as well as (4) the execution of approach or avoidance behavior (Strack & Deutsch, 2004). Within the scope of the present work only the aspect of positive as well as negative affect regulation is important. Athletes with a tendency to

up-regulate positive affect are assumed to engage in behavior or process information in accordance with approach orientation (like trying to finish a rally or emphasize on a good service in order to score a point). Players who tend to regulate towards negative affect are more likely to process and behave in an avoidance-oriented way (which then means avoiding seeking the decision within a rally, or playing longer matches).

In summary, behavior will be executed if both systems contribute to the activation of the same schema; even more so if positive affect is associated with a certain behavior (Winkielman & Cacioppo, 2001). In the impulsive system behavior is caused by the *frequency* and *recency* of associative links. In the reflective system behavior is based on decisions about the *desirability* and *feasibility* of an action (see also Figure 1.2). However, these decisions can be indirectly influenced by the impulsive system. Both systems compete with each other when different schemata are activated in the respective system. When conditions from the reflective systems are not met the impulsive system may determine behavior, sometimes for the better, other times in a disruptive or damaging way (Deutsch & Strack, 2005).

Concepts like attitudes, decisions, goals, habits, needs, and motivational orientations make a vast contribution to the understanding of human behavior (Strack, et al., 2009):

“For example, goals allow behavior to be influenced by delayed consequences, choices create links to rationality, attitudes allow quick evaluations, habits capitalize on regularity and allow for automatization, needs connect behavior to biological necessities, and motivational orientations allow quick and global behavioral orientations.” (p. 108-109)

In order to be able to predict a broad range of behavior, all of these concepts and their interaction are taken into account to formulate a theory of dual systems. In doing so Strack and Deutsch (2004) try to integrate a minimum number of principles into a theory that predicts a maximum number of behavioral phenomena. Most dual-process models only take into consideration one or two concepts (e.g. attitudes) and only few

approaches suggest a direct link to behavior (e.g. Metcalfe & Mischel, 1999). However, for the domain of applied sport psychology links to behavior are essential. That is why the reflective impulsive model is a good theoretical basis for dual processes in the sports domain and serves as an anchor for the dual-process motivation models presented in the following chapter.

Dual-Process Models of Motivation

In this chapter, two dual-process models of motivation are introduced. Bearing in mind the aforementioned areas in which dual processes could be found effective, one of the following models addresses duality of motivational needs and motivational orientations (Schultheiss, 2001) while the other model looks at the two motivational systems from a volitional perspective of goal pursuit (J. Kuhl, 2000a).

In general, the process of *motivation* is described as an energizing drive of certain aspects of the present life in the direction of the pursuit of a goal which is positively evaluated (Carver & Scheier, 1998; Rheinberg, 2002; Toates, 1986). More specifically, motivation is concerned with goal setting (selection, evaluation) which is directed by the feasibility and desirability of goals (Achtziger & Gollwitzer, 2008). Authors like Kuhl (2000b) even stress that the motivational phase (focus on the situation, outcomes, and consequences) must be dissociated from the volitional phase (preparing and performing an action) within Heckhausen and Gollwitzer's (Heckhausen & Gollwitzer, 1987) cognitive model of motivation (see Figure 1.2).

According to McClelland (1965) an (*implicit*) *motive* is a network of associations which is affectively toned and "arranged in a hierarchy of strength or importance" (p. 322). This network energizes, directs, and selects behavior directed at satisfying the motive and will be automatically activated with adequate environmental stimuli

(McClelland, 1980, 1987a). An anticipatory affective state energizes a behavior towards the incentive (e.g. task difficulty for the achievement motive) which is accordingly associated with a desired affect implicit motives are often referred to as needs. However, Kuhl (2010) emphasizes that motives in addition to the mere neurobiological needs (actual vs. nominal value) contain knowledge from experiences that help act contextually appropriate in different situations (pp. 542, 547-548). Initially, McClelland, Atkinson, and colleagues sought to measure the achievement motive without the influence of response biases, participants' cognitive abilities, or other situational factors (McClelland, Atkinson, Clark, & Lowell, 1953). That is why they used indirect ways of measuring the implicit motive through the Thematic Apperception Test (TAT; Murray, 1943). Recently, further developed indirect measures of the implicit achievement motive like the Picture Story Exercise (PSE; McClelland, et al., 1989; D. G. Winter, 1994, 1999), the Operant Motive Test (OMT; J. Kuhl & Scheffer, 1999; Scheffer, Kuhl, & Eichstaedt, 2003), or the Implicit Association Test for achievement motivation (IAT; Brunstein & Schmitt, 2004; Greenwald, et al., 1998) have been used. Anatomically, implicit motives are located in the midbrain regions (Thrash & Elliott, 2002).

Explicit motives are conceived as self-attributed desires (McClelland, et al., 1989). The dynamic components of the explicit motivational system (Weinberger & McClelland, 1990) are formed by subjective goals and behavioral intentions. However, when individuals evaluate whether they can identify with set goals or intentions they will consider their self-concepts, cognitive beliefs, and personal values, which are also part of the explicit motivational system (Brunstein, 2010). Explicit motives thus reflect personal interests and desires that are carefully weighed against expectations and demands from social situations (see Figure 1.2). Personal goal setting then also includes a process of deliberation and implementation of intentions (Gollwitzer, 1999). Explicit motives are traditionally measured in direct ways with questionnaires like the Personality Research Form (PRF; D. N. Jackson, 1999) based on Murray's (1938) classification

of needs, or the Achievement Motives Scale (AMS; Gjesme & Nygård, 1970; J. W. B. Lang & Fries, 2006) based on Festinger's theory of social comparison (Festinger, 1954). Anatomically, explicit motives are assumed to be located in the newer cortical regions of the brain (Thrash & Elliott, 2002).

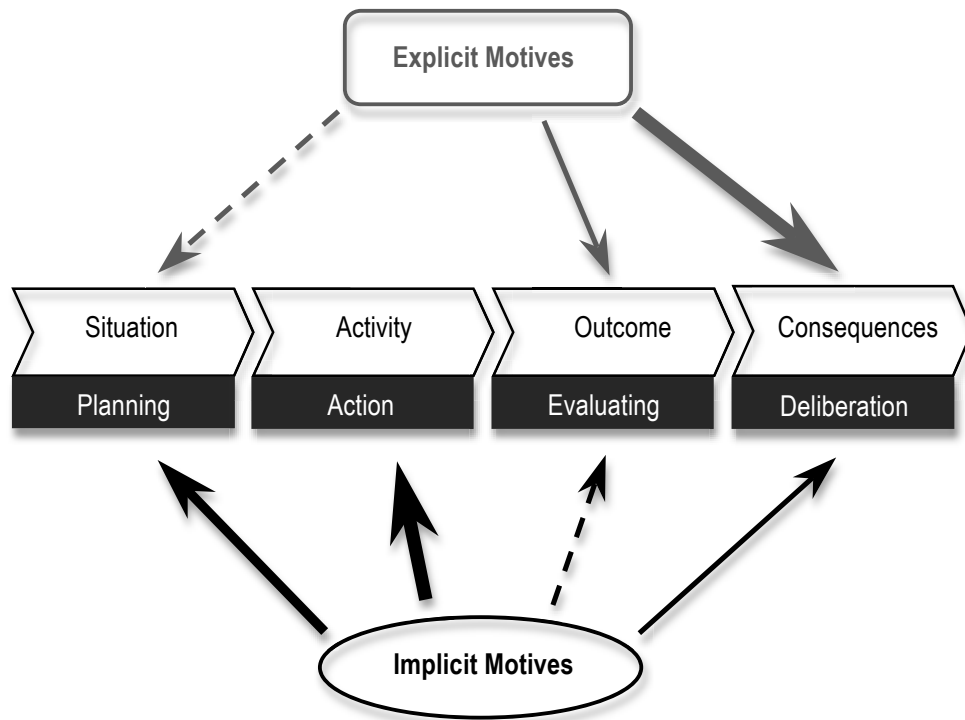


Figure 1.2 Hypothesized effects of implicit and explicit motives in Heckhausen's (1977), and Heckhausen and Gollwitzer's (Heckhausen & Gollwitzer, 1987) extended cognitive model of motivation (adopted from Rheinberg & Engeser, 2010)

Although there have been calls for studies that investigate both the implicit (affective) and explicit (cognitive) impact on behavior at the same time research that addresses both systems when primarily only interested in one is limited (Zajonc, 2000, p. 55); and in the field of sport psychology almost non-existing (for an exception, cf. Schüller, 2010). Measures for implicit constructs have been around for some time in social psychology (Fazio & Olson, 2003). Several researchers documented discrimi-

nant validity of indirect (implicit) and direct (explicit) motive measures. In two meta-analyses, Spangler (1992) could show that indirect measures of motivation (implicit motives) are strongly associated with outcomes when participants are intrinsically motivated. However, direct measures of motivation (explicit motives) are also associated with outcomes but only when individuals are extrinsically motivated. Within Spangler's analysis, both motivational systems are only modestly correlated ($r = .09$; for early findings see also deCharms, Morrison, Reitman, & McClelland, 1955). Accordingly, it could be shown that implicit motives better predict operant behavior while explicit motives rather predict respondent behavior (Biernat, 1989; deCharms, et al., 1955; Schultheiss & Pang, 2007). In an intercultural sample Pang and Schultheiss (2005) reported only little overlap between direct and indirect measures of motivation in thematically different areas (see also Schultheiss & Brunstein, 2001). Other authors however argue for the coherence of implicit and explicit motives and emphasize that differences between the two measures are a function of *content* and *method* as different facets of one motivational construct (Bilsky & Schwartz, 2008). Thrash and Elliot (2002) for example put forth that concordance between the two motivational systems can be moderated by other personality factors like self-determination, self-monitoring, or body consciousness, and is dependent on the content match of the direct and indirect measure (see also Thrash, Elliott, & Schultheiss, 2007). It has also been claimed recently that explicit motives may represent a coherent unity while measures of implicit motivation point to different personality competencies (Ziegler, Schmukle, Egloff, & Bühner, 2010).

It should be noted here that there has been a discussion on whether measures of reliability according to classical test theory apply to the indirect measures of motivation like the TAT (Atkinson, Bongort, & Price, 1977; J. Kuhl, 1978). Lundy (1985, 1988) responded to a critique on the psychometric properties of the TAT by Entwisle (1972) by stating that traditional measures of reliability (Cronbach's alpha) do not apply to the

TAT and reliabilities strongly depend on the way participants are instructed (Niitamo, 1999).

Information-Processing Model of Implicit and Explicit Motives

Schultheiss (2001, 2007a; Schultheiss & Pang, 2007) introduced a model of implicit and explicit motives based on the theoretical work of McClelland and colleagues (1980; McClelland, et al., 1989) as well as on theorists that distinguish between implicit and explicit forms of cognition and emotion (e.g. Nisbett & Wilson, 1977; Zajonc, 1980). Within the model not only thematic differences are assumed (achievement, power, affiliation) but also conceptual differences between implicit and explicit motives.

Implicit Motives. In Schultheiss' model, it is assumed that implicit motives are activated by nonverbal incentives or cues. Measures of implicit motives may not be verbalized or accessed by a person's self-concept (Schultheiss, 2008). Implicit motives manifest themselves in performance measures (see Figure 1.2), so-called non-declarative measures, or operant behavior, over which individuals have no conscious control (Schultheiss & Pang, 2007). McClelland (1980) specifies operant behavior as being spontaneously uttered and repeatedly generated over extended periods of time (e.g. athletic success or practice participation). Thus, implicit motives are learned through classical conditioning (Pavlovian learning) and instrumental learning (habit and skill acquisition) (Schultheiss, 2007b). They develop through affect-based experiences made especially in childhood before language is acquired (McClelland, 1987a; McClelland & Pilon, 1983). Hence, implicit motives are difficult to articulate and are assessed by indirect/ projective measures (see paragraph above; Thrash & Elliott, 2002).

Explicit Motives. Activation of explicit motives is achieved by verbal stimuli. Explicit motives show predictive value for declarative measures of motivation or respondent behavior over which individuals have conscious control. Conscious, deliberate decisions, environmentally stimulated and willingly influenced, are called respondent behavior (McClelland, 1980). Among these declarative measures are self-concepts, attitudes and beliefs, judgments, decisions, and goals (Schultheiss, 2008). Thus, explicit motives are prone to reflect what is expected by a person's social environment or culture (J. Kuhl & Kazén, 1994; McClelland, et al., 1989). These declarative statements are based on a person's semantic and episodic memory (Schultheiss, 2007b). Explicit motives are assumed to develop later in life because these self-attributed motives are learned through schemas encoded by the language system (McClelland & Pilon, 1983). That is why explicit motives can be accessed consciously and may be reported in direct motive measures like self-report questionnaires (Thrash & Elliott, 2002).

Interactions. Within the information-processing model of implicit and explicit motives interactions between the two systems are assumed. In the sense of division of work it is assumed that both systems could work in a kind of productive partnership (Biernat, 1989; McClelland, 1985a). The explicit motive would take over the part of directing attention to a certain goal (see Figure 1.2, planning) while the implicit motive functions to energize action toward the accomplishment of this goal (Brunstein, 2008). Moreover, interactions between both systems can also be carried out through *referential processing* (RP). Referential processing denotes the attempt to verbalize a nonverbal perception of an object. Vice versa, a person may generate a mental image for a verbal cue such as a word that has been read (Schultheiss, 2008). In the same way, other authors assumed and documented the effects of referential processing (e.g. goal imagery) for the alignment of goal commitment (explicit motive) to a person's implicit motive (Schultheiss & Brunstein, 1999; Weinberger & McClelland, 1990). Cross talk between implicit and explicit motives is also assumed to be a function of inter-individual

differences. Besides the ability for referential processing (Schultheiss, 2008) it is assumed that personality traits like extraversion vs. introversion (e.g., D. G. Winter, Stewart, John, Klohnen, & Duncan, 1998), self-determination (e.g., Thrash & Elliott, 2002), and the ability to regulate positive and negative affect are moderating variables for implicit and explicit motives (Baumann, et al., 2005; Brunstein, 2001; 2008; see also chapters on personality-systems interactions, and affect regulation). For example, Kuhl (2000a) put forward that especially when discrepancies between explicit goals and implicit motives exist people will use means of self-control in order to reach their self-incongruent goals. However, willingly trying to accomplish self-incongruent goals may lead to reduced emotional well-being, especially over an extended period of time (e.g., Brunstein, Schultheiss, & Grässmann, 1998; Brunstein, Schultheiss, & Maier, 1999). The three most common motivational themes found in TAT stories are achievement, affiliation, and power.

Achievement Motive. Individuals who seek success and feel proud when they have succeeded are assumed to be achievement motivated (Brunstein, 2008). It is a need that is affectively charged and activated whenever an individual faces a challenging task. Moreover, the achievement motive is satisfied when a person improves skills and reaches outcomes concerning this task (McClelland, et al., 1953). Failure is insofar an incentive for the achievement motive, success satisfies the motive (McClelland, 1985a). This is how affective changes influence the achievement motive. Down regulation of positive affect is an incentive for the achievement motive, which seeks satisfaction through positive affect by mastering a difficult task (see also chapter on affect regulation; J. Kuhl, 2000a). However, achievement motivated individuals with high hope for success prefer to work on tasks with medium levels of difficulty (McClelland, 1987a). Individuals low in the achievement motive either prefer easy tasks or tasks that are too difficult.

Only little is known about the biological basis of the achievement motive (cf. Schultheiss, 2008). Research has so far focused on the associations of the achievement motive with high muscle tone (Mücher & Heckhausen, 1962), high uric acid levels (cf. Kasl, 1974; Mueller, Kasl, Brooks, & Cobb, 1970) and low urine excretion (cf. McClelland, 1995), and high dopaminergic transmission (cf. Schultheiss & Brunstein, 2005). Low urine excretion volumes were attributed to the release of the peptide hormone arginine-vasopressin responsible both for retaining water and episodic memory processes (McClelland, 1995).

The development of the implicit achievement motive is fostered if learning daily routines was supported in early childhood (toilet training, fixed meal times). This autonomous achievement motive is further strengthened by the attempt to improve personal skills and make self-references (Koestner, Weinberger, & McClelland, 1991; Veroff, 1969). This is in line with assumptions that the ability to resist temptation and delay gratification is beneficial for the achievement motive (W. Mischel & Gilligan, 1964). In contrast, a social or explicit achievement motive (Veroff, 1969) is concerned with personal abilities in comparison to a norm or reference group (e.g. peers in school). The explicit achievement motive is more likely to develop if parents had expected their children to solve difficult tasks independently early in life.

Very few studies have focused on the discrimination of implicit and explicit motives in sports. Schüler (2010) documented for an achievement situation in sports (badminton, fitness) that participants with incongruence between implicit and explicit achievement motive reported less flow compared to non-achievement situations. These results could be replicated within experimentally manipulated situations. However, Schüler used a semi-projective measure for her research (Multi-Motive Grid; Sokolowski, Schmalt, Langens, & Puca, 2000). Gabler (1972) investigated implicit motives of high performance swimmers. He could show that they display higher levels of achievement motivation compared to a control group, which can basically be attributed

to the higher levels of hope for success in swimmers. An increased level of hope for success compared to fear of failure (net hope) was associated with longer practice hours at present and better personal best performances. Furthermore, in his study, no correlations could be found for high performance athletes between the indirect measure of the achievement motive (TAT) and a direct measures of personality (16PF; Cattell & Mead, 2008).

The focus of researchers on explicit motives in sport has been on task-related orientations within models like the *achievement goal theory* (Duda & Hall, 2001; Duda & Nicholls, 1992) or the *self-determination theory* (Deci & Ryan, 2000; Vallerand, Deci, & Ryan, 1987). Primarily, sport-related studies on the achievement goal theory found a connection between task orientation (gaining knowledge) and ego orientation (displaying superiority) with self-report measures of beliefs and attitudes. Findings suggest that athletes high in ego orientation find unsportsmanlike behavior (like cheating, or aggressive play) more acceptable (Duda, Olson, & Templin, 1991) and believe that success in sports primarily requires high ability (Duda & Nicholls, 1992). In contrast, task orientation for example is associated with the belief that success in sports requires interest, cooperation, and effort (Duda & Nicholls, 1992), a task-involving practice climate, and a positive attitude toward sportsmanship, the coach, and the athlete's sport as a whole (Fry & Newton, 2003). Task-oriented athletes also enjoy their sport more and experience less worry of competition (Newton & Duda, 1993). In addition, measures of intrinsic motivation are related to self-reports of more positive affect, well-being, exercise behavior, and less exercise anxiety (Sebire, Standage, & Vanssteenkiste, 2009). In studies with elite athletes (Chantal, Guay, Dobрева-Martinova, & Vallerand, 1996; Fortier, Vallerand, Brière, & Provencher, 1995) authors often find that competition, because of external evaluation and its evaluating character, seems to decrease intrinsic motivation and that competition in nature rather fosters extrinsic motivation (Deci, Betley, Kahle, Abrams, & Porac, 1981). In summary, findings on explicit

achievement motivation are primarily of interest for the area of physical education in school and leisure sports. The direct support of task orientation and intrinsic motivation for elite sports performance is questioned, however. In a study on the influence of different personality variables on the performance in critical situations, Carlstedt (2004a) described detrimental effects of the personality trait of absorption that resembles descriptions of achievement-motivated athletes (pp. 39-53). This type of athlete is excessively concerned with technical aspects, and displays a heightened ability for motor learning. However, Carlstedt (2004a) states that this kind of athlete may be more prone to performance slumps in critical situations (pp. 61-62).

Studies on the discrimination of the implicit and the explicit achievement motive in a non-athletic context repeatedly showed that the indirect motive measure better predicts participants' actual effort and faster learning. Choices (e.g. continuing an achievement task) and personal evaluations (e.g. achievement orientation of others) are in contrast related to direct measures of the achievement motive (Biernat, 1989; Brunstein & Hoyer, 2002; Dahme, et al., 1993; deCharms, et al., 1955). Sheldon and Elliott (1998) put forth that in pursuing their goals people invest more time and effort, are more persistent and successful, and feel better when goals are congruent with representations in the self-system (like implicit motives). Additionally, studies on the entrepreneurial and professional success suggest that indirect measures of achievement motivation (and power motivation combined) do predict productivity and creativity (McClelland, 1961; McClelland & Boyatzis, 1982; for power motive, see D. G. Winter, 1991). Direct measures are not able to do so. Within the school context however, direct measures of achievement motivation are of greater value since performance is tested externally (cf. Brunstein, 2008).

Generally, in the presence of task-oriented incentives without external pressure implicit motives predict higher effort and endurance in tasks that are new, complex, and

difficult (cf. Brunstein, 2008; McKeachie, 1961). In contrast, individuals high in the explicit achievement motive will preferably increase effort when they can present socially valued competencies or when they compete with others (Patten & White, 1977; Tauer & Harackiewicz, 1999).

Affiliation Motive. Individuals who want to establish, maintain, or restore social contact with others and experience joy and happiness in doing so are assumed to be affiliation motivated (Brunstein, 2008). As Atkinson, Heyns, and Veroff (1958) put it, persons with a high affiliation motive gain satisfaction from strengthening relationships with others and want to distance themselves from people who are not friendly or accepting (see also Koestner & McClelland, 1992; Schultheiss, 2008; D. G. Winter, 1996). As such, high affiliation individuals engage in more personal contacts and establish more eye contact with others, and are able to make concessions to people they like (e.g., Exline, 1963; Langner & Winter, 2001; Lansing & Heyns, 1959).

A hormonal basis for the affiliation motive is easy to justify since in other mammals it is also important to attach to parents and offspring in order to ensure safety and protection (Schultheiss, 2008; Wilson, 1980). Accordingly, the parasympathetic nervous system is more active (Insel & Young, 2001). Affiliation and attachment is associated with higher levels of the steroid hormone progesterone (Schultheiss, Dargel, & Rhode, 2003; Schultheiss, Wirth, & Stanton, 2004; Wirth & Schultheiss, 2006), increases in the peptide hormone oxytocin, lower blood pressure (through peripheral dopamine release), and better compensation of stress (Jemmott, 1987; Jemmott, et al., 1990; McClelland, 1979, 1989; McClelland, Ross, & Patel, 1985). This may be attributed to a stronger activation of the right hemisphere (holistic and intuitive processing) which could be found for affiliation-motivated individuals (see, e.g., J. Kuhl & Kazén, 2008). Wirth and Schultheiss (2006) summarize that individuals with a high affiliation motive experience higher levels of progesterone, and higher levels of progesterone support the affiliation motive, respectively.

On the one hand, the implicit affiliation motive more strongly develops when the mother had been less responsive to the child's crying. On the other hand, affiliation-motivated individuals' parents make more use of positive reinforcement (praise) as a child-rearing technique (e.g., Lundy & Potts, 1987; McClelland & Pilon, 1983). Furthermore, deprivation of warmth and cohesion (like for second-born, or institutionalized children) may lead to more pronounced levels of affiliation motivation (Connors, 1963; Youngleson, 1973). This is in accordance with the assumption of *homeostatic dysregulation* (Strack & Deutsch, 2004, p. 236). Strack and Deutsch (2004) assume that the deprivation of basic needs leads to the activation of behavioral schemata that led to the satisfaction of those needs in the past. This way, a motive becomes activated time and time again.

Sorrentino and Sheppard (1978) assessed the implicit affiliation motive using an indirect measure to predict athletes' performance in a swimming competition. It could be found that swimmers high in approval orientation swam faster when they contributed to a team performance (group condition). In contrast, rejection-threatened swimmers displayed slower swimming speeds in the group condition compared to when they swam for their individual success. This is in accordance with findings on affiliation-motivated individuals' better performance in tasks in which they needed to cooperate with others (Atkinson & O'Connor, 1966; French, 1958). Although affiliation-motivated persons cannot be found in top-management positions (McClelland, 1987b), they are highly appreciated in companies with less pronounced hierarchies (Litwin & Siebrecht, 1967). However, in competitive tasks¹ affiliation-motivated individuals usually show inferior performance (Koestner & McClelland, 1992). Further studies reported that students high in the implicit but not the explicit affiliation motive had actually more social contact (e.g. conversations) in the course of a day. On the contrary, the scores in ex-

¹ In competitive sports, it is assumed that high affiliation-motivated individuals have a problem with competing with or dominating others in the course of a competition (Marahrens & Keil, 2004).

plicit affiliation motivation were associated with the students evaluation in whether they preferred to do certain activities alone or accompanied (McAdams & Constantian, 1983; McClelland, 1985a).

For the avoidance component of the explicit affiliation motive, it could be shown that athletes with a high fear of rejection perform worse in, for example, a golf putt exercise when their performance counts for a team and not only for the individual (Teubel, 2011). Other authors pointed to the fact that athletes participating in leisure sports explicitly claim being highly motivated by the social experience of sport participation (Gabler, 2002; Sudeck, Lehnert, & Conzelmann, 2011). Furthermore, for non-competitive cyclers the social aspect of their exercise is the central reason for becoming involved in or maintaining cycling (Brown, O'Connor, & Barkatsas, 2009).

Power Motive. Individuals who seek to have impact on others and enjoy the feeling of power and dominance are said to be power motivated (Brunstein, 2008). This impact on others can be physical, mental, or emotional. However, highly power-motivated individuals perceive the impact of others as aversive (Schultheiss, Wirth, et al., 2005; Veroff & Veroff, 1972; D. G. Winter, 1973). Moreover power-motivated individuals to their advantage quickly pick up behaviors that help them dominate others and stop with behaviors that lead to being dominated (Schultheiss, 2008). Power motivation may sometimes not manifest itself in overt aggressive behavior but other more subtle, clever, and intelligent forms of having impact – as a kind of interpersonal intelligence (see, e.g., Brunstein & Schultheiss, 2002; McClelland, 1975, 1987b). This will generally lead them to higher positions in hierarchically organized corporations and more successful careers (McClelland & Boyatzis, 1982; McClelland & Burnham, 1976; McClelland & Franz, 1992; Peterson & Stewart, 1996). Furthermore, power-motivated individuals can be found more often in jobs in which they teach others (D. G. Winter, 1973).

The socio-biological basis for the power motive is also comprehensible. In view of limited resources it is essential to rise in the social hierarchy in order to have control over these resources (Schultheiss, 2008; Wilson, 1980). The steroid hormone testosterone is linked to dominant behavior across species (Monaghan & Glickman, 1992). In humans the implicit power motive is associated with testosterone (Schultheiss, Campbell, & McClelland, 1999). Humans high in the implicit power motive respond to dominance challenges with an increased activity of the sympathetic nervous system: increased levels of epinephrine/ norepinephrine (e.g., McClelland, et al., 1985), increased blood pressure (e.g., Fontana, Rosenberg, Marcus, & Kerns, 1987), and increased muscle tone (Fodor, 1985). Testosterone supports energy supply to the muscle and lowers the threshold for aggressive behavior (Sapolsky, 1987; Schultheiss, 2007a). In power-motivated men an enhanced activation of epinephrine and norepinephrine seems to be associated with instrumental learning in the context of a contest (Schultheiss, Wirth, et al., 2005). However, in power-motivated women it is not testosterone but estradiol which increases after victory (Stanton & Schultheiss, 2007). Other authors were able to associate power motivation with activation of the left hemisphere, in which instrumental planning and linear thinking is located (see J. Kuhl & Kazén, 2008).

Concerning the child rearing practices of parents, an implicit power motive is more likely to develop for example in a permissive atmosphere in which aggressive behavior on the child's part is tolerated (McClelland, 1987a; McClelland & Pilon, 1983; Sears, Maccoby, & Levin, 1957). In the presence of a father or younger siblings the power motive may develop toward a more "social" type (D. G. Winter & Stewart, 1978). By contrast, individuals high in the explicit power motive had been punished more often especially when they had been aggressive against their parents.

Studies on the discriminant impact of implicit and explicit power motivation on sports performance are rare. From a practical point of view it is important for high per-

formance athletes to be able to execute power over themselves and their opponent. Athletes insofar need a power motive that is directed at themselves and at others (McClelland, 1975). Practical sport psychologists found that the power motive is especially pronounced in athletes in team sports or interaction sports like competitive racquet sports or in the martial arts, in which athletes face an opponent (U. Kuhl & Krug, 2006). In a study by Schultheiss, Campbell, and McClelland (1999) power-motivated winners experience higher testosterone distribution before and after a competition. In the light of this study, inconsistent findings of elevated testosterone concentrations before and after competition (e.g., in tennis, Booth, Shelley, Mazur, Tharp, & Kittok, 1989) in contrast to no elevation of testosterone concentrations after a contest (Gonzalez-Bono, Salvador, Serrano, & Ricarte, 1999) can be better understood. The power motive seems to be a moderating variable between contest and testosterone flow. A comparable moderating role of direct measures of dominance for this effect could not be found (Archer, 1991; Mazur & Booth, 1998). Schultheiss and colleagues (2005) reported another finding with relevance for competitive sport. They could show that performance of power-motivated individuals was impaired in an implicit learning task when they were exposed to angry faces. However, no performance impairment was observed after neutral or happy faces (Schultheiss, Pang, et al., 2005).

Studies on the explicit power motive in sports are rare. For example, it could be shown that elite athletes are higher in their explicit power motive than non-athletic participants (Tusak, 2000). Different levels of explicit power motivation were also illustrated in basketball for example. Guards displayed highest levels of power motivation while centers were least power motivated (Erculj & Vicic, 2001).

In studies on the professional performance of power-motivated individuals they were rated more competent and performed better in environments that support power hierarchies. For example, in a presentation on a neutral topic like animal testing, individuals with a high power motive were externally rated more intelligent and competent

than individuals low in the power motive. This advantage was neither due to a higher quality of their arguments nor dependent on more dominant or socially incompatible behavior. Rather, implicitly high power motive individuals seemed to impress external raters by a high speed of speech and elaborate gestures (Brunstein & Schultheiss, 2002). Furthermore, environmental incentives are important for different motives to become effective. Achievement-motivated individuals for example benefit from an environment with achievement-related incentives (autonomy, challenging tasks, feedback) while power-motivated individuals are better promoted in environments with power-related incentives like a hierarchical structure (Andrews, 1967; Jenkins, 1994). Studies with semiprojective measures of the power motive could show that managers evaluate their motivation (intrinsic and extrinsic) toward their job and the leadership training they participated in as higher when they are highly power motivated (Sokolowski & Kehr, 1999; Sokolowski, et al., 2000).

Conclusion. Only few studies have been conducted examining the discriminant validity of implicit and explicit motives in sport and exercise. Theory suggests that implicit motives primarily energize actual behavior and manifest themselves in real performance measures. In contrast, explicit motives are self-attributed desires, decisions, and intentions based on their social acceptance. It could be shown that implicit motives manifest themselves in performance outcomes like practice hours, competition results, and effort invested (Gabler, 1972). This is especially true for the achievement motive. Additionally, congruence of the implicit and explicit achievement motive allows for more flow experiences in athletes. The power motive helps individuals having effect on others by, for example, being convincing (fast speech, elaborate gestures). Winning is important for power-motivated individuals and leads to the respective physiological responses. Athletes, especially from interaction sports like racquet, and team sports as well as martial arts are more highly power motivated. Furthermore, elite athletes are oriented toward demonstrating ability (ego orientation) and are preferably extrinsically

motivated. Different to the achievement and power motive, affiliation-motivated athletes' performance is impaired in competitive situations and hierarchical settings unless social support or a meaningful group atmosphere is provided.

Personality-Systems-Interaction Theory (PSI)

Kuhl (2000a) put forward a theory of interacting cognitive systems that are modulated by the regulation of positive and negative affect. PSI theory is a dual-process model that integrates needs and motivational orientations as well as concepts of goal pursuit into one model of self-regulation (Carver & Scheier, 1998; Strack, et al., 2009). The model also describes how the process of pursuit of a certain desired state from an actual state is being monitored (volition). Similarly, models that focus on the self-control and self-regulation of action have been proposed by Metcalfe and Mischel (1999) as well as Carver and Scheier (1998). In accordance with Kuhl (2000a), in their cybernetic model of self-regulation Carver and Scheier (1990) also emphasize the role of positive and negative affect. From their point of view, self-regulation is a process of controlling whether a behavior observed contributes to the pursuit of a certain goal state. If goal pursuit works too slowly, negative affect will arise which consequently leads to more effort being invested. On the other hand, if a goal is achieved faster than needed positive affect will result and will reduce a person's effort (Carver & Scheier, 2000). However, in contrast to PSI theory, affects are not the activating force within this model. Since the system always strives for homeostasis, a process of meta-monitoring of goal pursuit causes positive and negative affect shifts instead. Duality is manifest within the model since the *affect loop* controls the intensity of behavior (energizing aspect) while the *action loop* directs it. The vicinity to the definition of explicit and implicit motives becomes apparent herein. The dual model by Metcalfe and Mischel (1999) focuses on the volitional part of action. A *hot* (emotional) "go" *system* initiates fast,

automatic action while a *cool* (cognitive) “know” *system* is responsible for self-controlled action. What makes the model a rival to the PSI theory are the assumptions on performance within suboptimal levels of stress (arousal). Metcalfe and Mischel (1999) assume that difficult intentions can only be processed by the cool system and need time for processing (Gollwitzer, 1996; J. Kuhl, 1985). Under very low or very high levels of stress the cool system’s capacity for processing is impaired and the hot system will take over² (Metcalfe & Jacobs, 1998). Although assumptions on the workings of implicit and explicit processes under stress are very fruitful, a more elaborate description of the processes of self-control and self-regulation is forgone.

PSI theory proposes that four cognitive macrosystems participate in information processing. Analytical thinking is processed by a memory for explicit intentions (intention memory; IM), the extension memory (EM) makes holistic emotional processing possible through a network of semantic fields. These two memories represent the duality of the model at a higher inferential level. On a lower inferential level duality is represented by the intuitive behavior control (IBC) and the system of object recognition (OR), which recognizes discrepancies of an object (J. Kuhl, 2000b). Systems of the PSI model are easy to integrate into assumptions of duality and interactions between dual information processes (cf. Strack & Deutsch, 2004). For example, the reflective system uses perceptions to categorize knowledge and plan behavior much like the systems of object recognition (OR) and intention memory (IM). The rich knowledge saved in the extension memory (EM) is also used by the intention memory (IM) in order to make plans and set goals for behavior to be initiated. Thus the impulsive system EM

² The cool system operates under low to moderate levels of cortisol. Type I receptors (mineralcorticoids) are sensitive to cortisol, activating the hippocampus. In contrast, at high levels of stress type II receptors (glucocorticoids), which inhibit the hippocampus, are little sensitive to cortisol and will not become activated until cortisol levels are high. Processing of the hippocampus (moderation between the hot/cold system) consequently becomes impaired accompanied by the inhibition of higher order cognitive and self-regulatory systems (the hot system takes over) in the neocortex (J. Kuhl, 2010; Sapolsky, 1992).

interacts with the reflective system IM for the purpose of setting goals (cf. Figures 1.2 and 1.3).

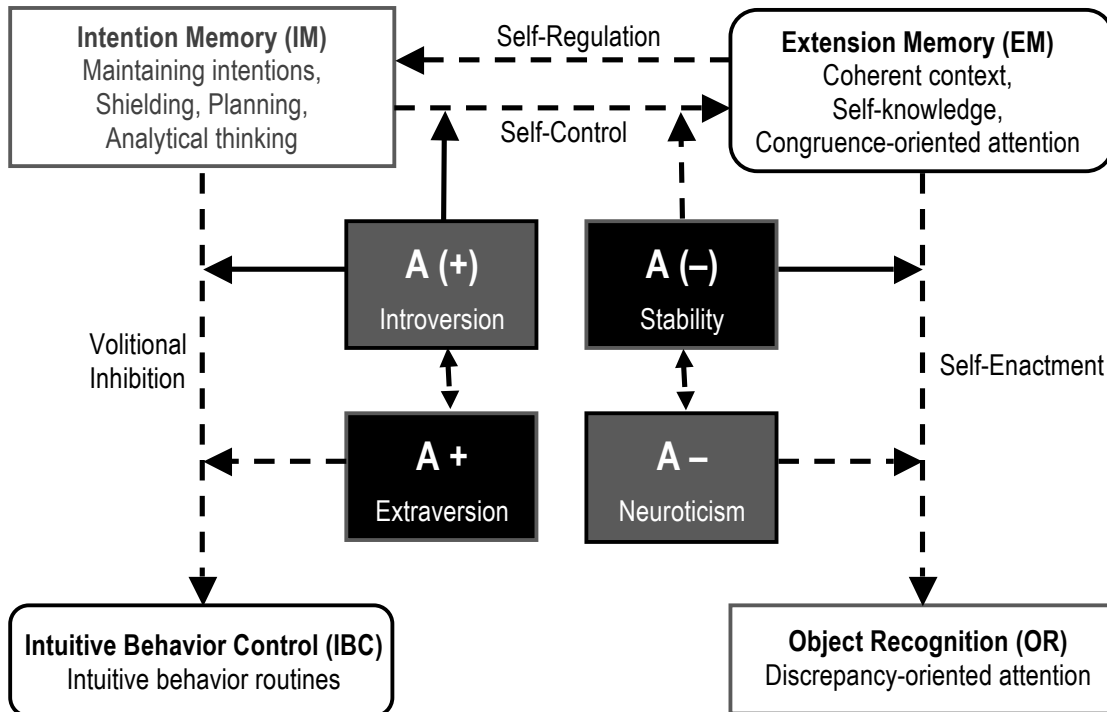


Figure 1.3 The affective core processes of the Personality Systems Interaction theory. Dashed arrows indicate inhibitory relationships between systems; solid arrows indicate facilitating relationships (J. Kuhl, 2000b)

Intuitive Behavior Control (IBC). Behavioral routines and automatisms generally hardly need conscious intentions to initiate action (J. Kuhl, 2000a). These intuitive programs are partly genetically predisposed, becoming active after only slight emotional stimuli, and are often linked to motor programs. Insofar, links to behavior appear to be robust and can already be observed in intuitive behavior programs of infants. Functional characteristics of intuitive behavior are described in research on motor control for example (Jeannerod, 1994). Furthermore, through its way of holistic processing, the intuitive behavior control is highly able to integrate information from different contexts

and works congruence-focused. The IBC is more concerned with processing information that deal with present and future events (see Figure 1.2, deliberation, planning; J. Kuhl, 2000a). Anatomically, it is located in the parietal area of the right hemisphere (dorsal system) and controls motor movement through connections to the prefrontal cortex (J. Kuhl, 2010, p. 88). In high performance athletes like tennis players such automatisms are present when serving for example. The player plainly needs to activate this automatism by planning to hit a twist serve and readily activates the correct grip, foot placement, or timing for hitting the ball.

Object Recognition (OR). Besides the IBC, the system of object recognition is also a low inferential system. It is located in the left parietal cortex and provides access to the inferotemporal cortex of the ventral system (J. Kuhl, 2010, p. 88). In contrast to the intuitive behavior control system, object³ recognition strongly decontextualizes information and keeps this information specific to the respective subcategory. Thus the system is more concerned with differences than with similarities of objects. This is efficient when new information needs to be aligned with previous experiences. Moreover, processing within the OR is analytical and is more concerned with analyzing past experiences (see Figure 1.2, evaluating, deliberation; J. Kuhl, 2000a). In sports it could be of importance to take an inventory of the present state of the competition before planning further actions needed to be successful.

Intension Memory (IM). The intension memory is one of the two high-inferential systems (in addition to EM). In accordance with OR, intension memory hosts analytical thinking, verbal processing as well as planning, and problem solving. It is very precise in nature. The IM is a memory for intended actions that are stored explicitly, can be accessed consciously, and are attributed to left-hemispheric and prefrontal processing (Knight & Grabowecy, 1995; J. Kuhl, 2000a). Information processing in the IM is se-

³ Objects may be affects, thoughts, concrete goals, needs, or internal states as long as they can be segregated from their contexts (J. Kuhl, 2000b, p. 671).

quential, slow, and vulnerable to an individual's stress. The system is able to store difficult intentions (that cannot be carried out immediately) as long as positive affect for the implementation of the intention is not present (J. Kuhl & Kazén, 1999). For the IM, it is practical to plan actions and form difficult intentions whenever an intuitive routine for a certain task is not at hand, or a situation does not support the initiation of an action. Such *difficulties in enactment* lead to an inhibited pathway to IBC and strengthened information processing with intention memory (see Figure 1.3; J. Kuhl, 1984, 2000a). The intention memory is directed toward future events. Persons who generally strongly focus on the intention memory experience high levels of self-control.

Extension Memory (EM). Similar to the IBC, processes in the extension memory are more holistic and global, and relate to the concept of intuition and feeling (J. Kuhl, 2000a). In contrast to the IM, the extension memory processes in parallel making it a fast system. These processes are also very flexible and robust in the face of additional external and internal stress since they call on associations which have been established already. Since the extension memory is a huge, semantic, right-hemispheric network of associations it is able to integrate seemingly contradictory aspects of an object rather than contrast supposedly opposite features (J. Kuhl, 2000a). Thus, in the planning phase of Heckhausen's cognitive model, attention is congruence-oriented (cf. Figure 1.2). Individuals who usually act out of the extension memory show *self-regulated* behavior. Although they may not be able to verbalize the reasons for their actions they feel that they are doing the right thing. Different to the IBC, the EM includes implicit self-representations such as needs, emotions, somatic feelings, and values, which are considered when making decisions the EM is involved in. This is a sophisticated difference to Jung's understanding of the unconscious and comparable to the concept of *autonoetic*⁴ consciousness (J. Kuhl, 2000a; Schacter & Tulving, 1994;

⁴ Autonoetic denotes a form of consciousness that allows for subjective awareness of time. This is important for the process of remembering – “mental time travel” (Tulving, 2002, p. 2).

Tulving, 1985). Moreover, Kuhl alludes to the fact that the ability for affect regulation is an integral part of the higher order system EM of feeling; and not of the IBC. Anatomically, it is located in the prefrontal part of the right hemisphere.

Interactions. The four cognitive macrosystems work antagonistically. The more one system determines behavior and experience the less the adjacent system is activated (see Figure 1.3; J. Kuhl, 2000a). As such, activation of intention memory leads to impulse control in a top-down manner – intuitive behavior is delayed as long as no positive affect is upregulated and no opportunity is given to act from learned routines. Alongside, strong activation of self-representations in the extension memory causes a top-down inhibition of the recognition of incongruent stimuli (OR). Thus, unwanted perceptions are repressed as long as a person acts out of the associations built up in the extension memory (J. Kuhl, 2000a). Furthermore, as long as a person is able to act out of her personal experiences planning and conscious goal pursuit is avoided by inhibition of the intention memory. Contrastingly, if a person is too rigid in pursuing explicitly set goals by strongly activating intention memory alternative actions are hard to detect because of the inhibition of the extension memory (J. Kuhl, 2000b).

Self-Enactment. The process of forming intentions by regarding all self-representations (needs, values, emotions, etc.) in the extension memory is called *self-regulation*. Under stress the ability to form self-congruent goals might be impaired. Especially when negative affect is high a person might not be able to get a feeling of his values, emotions, and needs. This might be the case in stressful life events but could also occur in sport competition particularly when a player experiences critical situations (e.g., at the end of a match). This reduced ability to adjust OR-perceptions with the self-system is called *self-inhibition* and is associated with performance impairment (J. Kuhl, 2000b).

Volitional Inhibition. In the same way, the exchange between the planning system (IM) and the intuitive behavior control (IBC) may break down due to a high amount

of stress. Normally, a process that is directed at pursuing goals set in the intention memory is called self-control. Under high levels of stress however, an athlete might ruminate in deliberate thinking about alternative ways of playing within a critical game situation. This may lead the athlete to shifting much of the cognitive capacity to processes of planning within the IM. The inability of implementing intentions into action is called volitional inhibition (J. Kuhl, 2000b).

Affect Regulation

Affect. Affects may influence behavior in various fashion – from automatic reflexes, to the direction of attention up to complex decision making (Damasio, 1994; J. Kuhl, 2000a; P. J. Lang, 1995). Fear, anger, sadness, disgust, happiness, and surprise have been described as basic universal facial expressions of *emotions* (Ekman, 1994). However, different theories exist about how emotions are produced. It was assumed early on that emotions are a response to different bodily perceptions and reactions (James, 1884). In contrast, Cannon (1927) suggested that arousal, behavior, and emotional experience all happen at the same time as a reaction to brain processes following a stimulus. Yet another theory put forward that an emotional experience is the result of a cognitive appraisal in a given situation following a stimulus that caused a physiological reaction (Lazarus, 1991a, 1995; Schachter, 1971). Brain research currently challenges the categorization of several emotions into one higher-order group of emotions (cf. LeDoux, 1995). Rather, the question was raised what an emotional atom was (Berridge, 1999) or whether an emotion could be unconscious (Berridge & Winkielman, 2003). The term emotion could be used as a reference for a self-perception of an automatic process or a bodily change (James, 1884; Russell, 2003). While an emotion is assumed to have an object at which it is directed (Oatley & Johnson-Laird, 1987) a *core affect* is usually object free (free-floating). Russell (2003,

p. 148) claims that research points to two primitive, universal, ubiquitous, and object-less dimensions of *valence* (pleasure-displeasure) and *arousal* (activation-deactivation) underlying the notion of emotion. He calls the combination of the two dimensions core affect. Other authors point to positive and negative affects as two distinct categories which are independent of each other (Cacioppo, Gardner, & Berntson, 1999; J. Kuhl, 2000a). Core affect is a neurophysiological state of a simple, nonreflective feeling that is part of hedonic arousal values and may be consciously accessed (James, 1884; Russell, 2003). For Kuhl (2010, p. 541), affects are detectors of deficit states of needs. Positive affect detects the satisfaction of a need (approach-oriented), negative affect the presence of an avoidance-oriented need. Core affects have the capacity to describe moods and are the basis of emotions. This definition is in line with the notion of *affect* by Watson and Tellegen (1985) as well as *mood* by Morris (1989) and is not cognitive or reflective (Zajonc, 2000).

Affect and Cognition. According to Zajonc (1980), affects are generated through conditioned responses to stimuli or through a person's needs, and a person may not be consciously aware of them (rather implicitly). In contrast, affects may also explicitly arise as a function of predictability and controllability as a result of a cognitive evaluation process (Lazarus, 1984). Explicit processes of affect regulation have been well documented (Gross, 2001; Richards & Gross, 2000). Lately, research has also focused on the regulation of implicit affect (Koole, 2009; Mauss, Bunge, & Gross, 2007), which is less effortful than deliberate affect regulation (Bargh & Chartrand, 1999). Within a framework of dual-processes, for example, it is assumed that associative links in the impulsive system are dependent on *positive* and *negative affect* – besides *frequency*, *recency*, *valence* – with which two stimuli are connected (Strack, et al., 2009). Neurobiologically, Zajonc (1980, 2000) argues for the independence of affect from cognition since the amygdala is reached by a stimulus from the hypothalamus 40 msec earlier than the hippocampus. Moreover, he could show that an affect could be subliminally

activated by the presentation of frowning or laughing faces without conscious awareness by the participants (Murphy & Zajonc, 1993). According to Quirin, Kazén, and Kuhl (2009), indirect measures of affect may assess the cognitive accessibility to an affective concept represented on a subconscious level. Furthermore, indirect measures are associated with hormonal parameters to which direct measures of affect are not related (cf. Russell, 2003). Additionally, it is assumed that affect change is realized within two steps (Koole, 2009; Lazarus, 1991b). Affect at first reacts to a certain stimulus with a high amplitude, and in a second step affect regulation assures that affect levels can return to homeostasis (Quirin, Bode, & Kuhl, 2011). This affect switch is more closely described by Forgas and colleagues (Forgas, 2000; Forgas & Ciarrochi, 2002).

Within the PSI theory both explicit and implicit affect concepts can be integrated (J. Kuhl, 2000a; LeDoux, 1995). Herein, positive and negative affect not only regulate approach and avoidance behavior (cf. Atkinson & Birch, 1970; Elliot & Church, 1997; Higgins, 1997) but also activate four cognitive macrosystems (J. Kuhl, 2000b). A special feature of the theory refers to emotional dialectics. In the century before the last that James (1890) already stated that pleasure supports behavior while pain inhibits it. One of Kuhl's assumptions is that a dynamic (dys-)activation of positive affect leads to efficient pursuit of goals (volitional efficiency) while the regulation (up and down) of negative affect fosters self-growth (J. Kuhl & Fuhrmann, 1998). Within the present work, this is especially important when it comes to stressful situations within competition. It is assumed that athletes who are able to dynamically shift between affective states are better able to (re-)act in critical situations of competition. This ability develops much like classical conditioning: whenever adjacent systems become repeatedly activated within a small amount of time (< 800 ms) the ability to regulate affect and the connection between the two systems will be strengthened (J. Kuhl, 2000a). This interplay needs particular parental support when children are very young.

Regulation of Positive Affect (PA). According to Kuhl's (2000a) first modulation assumption, volitionally pursuing goals is supported by the activation of positive affect (A+). In contrast, a person's focus on intentions (IM) is strengthened when positive affect is low (down regulated, A[+]; see Figure 1.3). Positive affect initiated through the activation of the extension memory also accounts for processes like intrinsic motivation by for example activating values connected with a goal or activity (self determination theory; Deci & Ryan, 1991). In the light of PSI theory it is assumed that implicit positive affect is generated by access to the self/ extension memory (Quirin, et al., 2011). Thus, the self may be involved in implicit affect regulation (Jostmann, Koole, van der Wulp, & Fockenberg, 2005; Koole & Jostmann, 2004). The self provides a network of different aspects that could be of importance for the pursuit of certain goal. The connection of one aspect with positive affect may support the pursuit of a goal that is part of the associative network (Bargh, Lee-Chai, Barndollar, Gollwitzer, & Trötschel, 2001). Positive affect may thus contribute to volition even unconsciously (see also chapter on unconscious volition; Custers & Aarts, 2005). Kuhl (2000a) adjusted the concept of action orientation into the direction of affect regulation (see paragraph on action vs. state orientation). Consequently, decision-related action orientation – when a person is able to integrate intentional aspects of a behavior for the benefit of an action – can be perceived as ability to regulate positive affect.

Regulation of Negative Affect (NA). Under negative affect (A–) discrepant information is perceived via the low-level object recognition system. If a person is able to downregulate negative affect (A[–]) access to self-representations in the extension memory will be facilitated (see Figure 1.3). This is Kuhl's (2000b) second modulation assumption on how affects regulate the interaction between the four cognitive macro-systems. Object recognition is associated with negative affect because the mismatch between perception (OR) and expectation (EM) generates the negative affect (J. Kuhl, 2000b). Neurobiologically, the ability to downregulate negative affect (stress-reducing

function) is located in the hippocampus (Sapolsky, 1992). This also means that activation of the hippocampus supports downregulation of cortisol concentration. In the hippocampus, as Kuhl (2000a) puts it, not only isolated perceptual, spatial, and cognitive information but also emotions, values, and needs become integrated into one coherent representation (McClelland, et al., 1995). However, when stress levels are too high to be downregulated the access to self-representations is inhibited (Pavlidis, Watanabe, Magarinos, & McEwen, 1995). Again, failure-oriented action orientation – the ability to avoid negative evaluations of a past behavior in order to act at optimum for the action at issue – can be perceived as the ability to regulate negative affect (see section on action & state orientation, J. Kuhl, 2000a).

For the process of motivation an affective change is a prerequisite (McClelland, 1985b). The achievement motive, for example, is stimulated by the opportunity to achieve a certain standard of excellence (McClelland, et al., 1953). Meaning that as long as the person remains in a state that helps him or her to identify discrepancies and do further planning in order to carry out a task more precisely the achievement motive is satisfied. Thus, negative affect can high and positive affect should be low for achievement-motivated individuals. For power-motivated individuals, affect regulation helps them satisfy their motive. A standard of excellence is not important to power-motivated individuals. Rather, they do everything in order to having an impact on others (McClelland, 1985b; D. G. Winter, 1973). To this end, it is important to constantly shift knowledge from discrepancies to goal achievement over into the self. In this fashion, the knowledge can be used in future attempts to having an impact on others. Power-motivated individuals therefore need to downregulate negative affect. This positive association between the ability to regulate negative affect and the power motive, and the negative link between negative affect regulation and the achievement motive could be illustrated in Study Three.

Studies on Affect in Sports. Several researchers documented a higher left hemispheric activity for athletes compared to non-athletes when acquiring a new motor task (Etnier, Whitwer, Landers, Petruzzello, & Salazar, 1996; Landers, et al., 1994). This left hemispheric activity⁵ is attributed to an unique cortical organization of athletes (Carlstedt, 2004b) which is also associated with higher positive affect (Drake, 2002; Drake & Myers, 2006) and reports of lower levels of distress and negative affect for athletes compared to non-athletes (Steiner, Denny, & Stemmler, 2010).

For Carlstedt (2004a) the ability to regulate affect during stressful situations (*repressive coping*; Crowne & Marlowe, 1960) prevents the left hemisphere from being influenced by negative affect from the right hemisphere (p. 64). Meaning that repressive coping prevents stress levels from becoming conscious. This is important in critical situations because cognitive activity in the left hemisphere may lead to deteriorated motor performances (Hatfield, Landers, & Ray, 1984; Langer & Imber, 1979). That is why repressive coping is also called the functional disconnection syndrome (Davidson, 1984; Schwartz, 1990). This shielding effect may help athletes perform better in critical situations (Hatfield & Kerick, 2007). The findings are in accordance with results by Tomarken and colleagues who could show that activation of the left anterior cortex is associated with positive affect and high repressive coping (Tomarken & Davidson, 1994; Tomarken, Davidson, Wheeler, & Doss, 1992). High repressive coping in turn reflects an increased activation of autonomic and endocrine mechanisms that enhance stress (Carlstedt, 2004a; Tomarken & Davidson, 1994). While repressive coping is rather located in the left hemisphere neuroticism, which is associated with negative affect, is rather located in the right hemisphere. Furthermore, athletes who are high in neuroticism are more in danger of experiencing performance lapses at high arousal levels (Carlstedt, 2004a, p. 4).

⁵ These lateralization effects were assessed by using the line-bisecting test (Drake & Ulrich, 1992).

In other studies positive and negative affect have been mainly drawn on as measures of well-being and health, and have been associated with the concepts of anxiety and coping (Arent, Landers, & Etnier, 2000; Craft & Landers, 1998; Long & van Stavel, 1995; Ntoumanis & Biddle, 1998; Reed & Buck, 2009). Positive affect is an integral part of the concept of well-being (Lyubomirsky, King, & Diener, 2005; Watson, Clark, & Tellegen, 1988), sometimes even used interchangeably (Arent, et al., 2000), and can be associated with physical health measured for example by heart rate, or cortisol levels (Steptoe, Wardle, & Marmot, 2005). The effects of cardiovascular and resistance training on negative affect (depression, anxiety) have been documented (North, McCullagh, & Tran, 1990; Petruzzello, Landers, Hatfield, Kubitz, & Salazar, 1991). It could be shown that chronic and acute exercise help to reduce negative affect. Respective findings have been made for positive affect (Arent, et al., 2000; Reed & Buck, 2009; Reed & Ones, 2006) which is enhanced by chronic as well as acute exercise. Furthermore, Jones, Swain, and Harwood (1996) could show that negative affect in athletes is associated with a higher competitive trait anxiety intensity while positive affect correlates rather with the direction of the perceived competitive trait anxiety. That means that athletes high in positive affect are more likely to see trait anxiety before competition as a necessary precondition to perform at optimal level (debilitative vs. facilitative). Elite performers interpret high anxiety intensity as more facilitative than non-elite athletes (Jones, Hanton, & Swain, 1994).

Another focus has been put on the effects of coping and exercise on positive and negative affect. In support of Folkman (1984), coping strategies in sport and exercise are distinguished into task-oriented (or problem-focused) and avoidance-oriented (or emotion-focused) (Crocker & Graham, 1995). Task-oriented coping strategies include direct attempts to deal with a source of threat and challenge (like increasing effort, planning) and usually correlate with enhanced positive affect. Task-oriented strategies could be of higher value in situations that can be controlled. With avoidance-

oriented coping strategies athletes in turn try to divert attention away from the situation or try to change its meaning. Avoidance-oriented coping strategies generally correlate with negative affect and might be more adaptive for uncontrollable situations (Ntoumanis, Biddle, & Haddock, 1999). Another interesting aspect was examined by Gaudreau, Blondin, and Lapierre (2002). They studied the affective change an athlete goes through in competition. Affect levels prior to and after a competition were analyzed. Cerin, Szaba, Hunt, and Williams (2000) point out that only a few studies actually assessed affective states or anxiety during competition. However, in the field of sport psychology it was not examined how the ability to regulate positive and negative affect can have an impact on sports performance. In contrast, studies on action vs. state orientation as a measure of affect regulation made this attempt.

Action & State Orientation. The PSI theory (J. Kuhl, 2000a) extends Kuhl's earlier action control theory (J. Kuhl, 1984) by the assumption that unconscious volition is possible (cf. Düker, 1983). Action control theory is based on assumptions on the workings of will by the German author Narziss Ach (e.g., 1935). This theory can be called volitional, primarily because it includes the control of shielding an intention against other motivational tendencies as well as the control of implementing the intention (J. Kuhl, 1983). Action control thus helps to form and implement an intention even against barriers. Kuhl (1984) found that people differ in their ability to deactivate an intention (perseveration). Generally, an intention will be deactivated after an action has been completed. A person then evaluates the action and integrates the results into the self (Beckmann, 1994). However, sometimes an intention cannot be transferred into action because of lack of opportunity. Some people consequently still ruminate on an action that could not be finished (intrusions) while others are able to fully concentrate on a new task. Such "degenerated intentions" (J. Kuhl, 1983, p. 253) cause an imbalance between (1) a desired future target state, (2) a current state that needs to be changed, and (3) the discrepancy between current and target state. Thus, whenever a person's

attention is focused on either a past, present, or a future state without having intentions active that could change the state, this person is assumed to be in a *state orientation* (J. Kuhl, 1983). If a person is able to control the negative impact of intrusions on action then the person is said to have an *action orientation* (J. Kuhl, 1984).

Now state orientation can be directed at a present or future action insofar as thoughts about alternative actions may impair the implementation of the actual intention. The person is caught in a process of *hesitation* in which attention is directed at several alternative action plans rather than focusing on the one important intention. Kuhl (1994) calls this process decision-related state orientation. Within the PSI theory decision-related state orientation is associated with the regulation of positive affect (see section on affect regulation). When a person is able to shift between high and low positive affect states dynamically implementation of an intention is supported.

State orientation may also be concerned with a past state or experienced failure. After failure the evaluation of the poor result of an action may cause a person to *ruminate* on the failure and thus have a detrimental impact on a subsequent action. This process is called failure-related state orientation (J. Kuhl, 1994). In contrast to hesitation, rumination is associated with the regulation of negative affect within the PSI theory. As long as a person is able to up- and downregulate negative affect the evaluation of an action will be comprised not only of perceptions of incongruent results but also of experience stored in the self (extension memory). The dispositional tendency for failure-related and decision-related state orientation (ability to regulate positive and negative affect) can be assessed by the action control scale (J. Kuhl, 1994).

The concept of action control was first derived from TAT stories for the achievement motive. Participants' stories varied in their reaction to barriers that arose when accomplishing an achievement goal (J. Kuhl, 1981). McClelland also proposed that for the achievement motive an affective change is mandatory. Failure, at first, is an incentive for the implicit achievement motive while success leads to the satisfaction of

the motive (McClelland, 1985a; McClelland, et al., 1953). Insofar modes of action control (affect regulation) are important moderators for motives to become effective.

Studies on Action Orientation in Sports. Studies on the effect of the regulation of positive and negative affect in sports are scarce. Affect regulation has mainly been focused on from a self-regulatory perspective on action- vs. state-orientation of athletes. In doing so researchers examined the effect of action-orientation on athletes' ability to make good decisions (Raab & Johnson, 2004; Roth & Strang, 1994), perform well under pressure (Heckhausen & Strang, 1988; J. Kuhl & Koch, 1984), enjoy advantages in the recovery process (Beckmann & Kellmann, 2004), or benefit participating in elite sports concerning their self-regulatory development (Elbe, Szymanski, et al., 2005).

In an experiment with high performance basketball players, Heckhausen and Strang (1988) instructed participants to perform at their personal best. According to their blood lactate level, heart rate, and running speed, all participants increased their effort on the task. However, only those athletes who are highly able to regulate positive affect (action-orientation) kept their heart rate and blood lactate at a beneficial level and showed the same number of baskets scored as in the control condition. Participants low in the ability to regulate positive affect (state-orientation) could not control their exertion, showed high levels of blood lactate, and increases in heart rate. Furthermore, they scored less baskets compared to the normal condition and made more mistakes dribbling the ball.

In a summary article on the action-orientation of top athletes, Beckmann and Kazén (1994) point to a differentiated picture on the affect regulation in performance in sports. They propose that athletes who are less able to regulate negative affect (state-orientation) show better standardized performance scores in *impulsive* sport types that only require short-term high-energy investment (e.g. short distance runs, jumps etc.). Here they do not need the ability to manage their physical and mental resources. How-

ever, in *controlled* sport types that also have a tactical component (e.g. long distance runs, walking), track and field athletes need the ability to regulate the expenditure of their resources. That is why action-oriented athletes show better standardized performance scores in these types of sports. Further, Beckmann and Kazén make a difference on another dimension: In *feedback* sports that require more complex actions and a constant monitoring of external information in reaction to the athlete's performance (e.g. volleyball, boxing, karate, judo), action-orientation (ability to regulate negative affect) is higher among athletes than among regular university students. However, in *flow* type sports requiring simple, coordinated, repeated movements of the athlete over time (e.g. long distance running, walking, swimming) there is no difference in the ability to regulate negative affect between athletes and non-athletes.

Roth and Strang (1994) support the differentiated view on the regulation of affect. They propose that athletes differ in their decision behavior depending on the ability to regulate positive affect. In two studies soccer players and sports students had to decide on the basis of different video scenes whether they would shoot in order to score a goal or whether to pass the ball in order to score from a different position. Under psychological demands (focus on either decision quality or decision time), state-oriented soccer players (low affect regulation ability) show only better decisions in respect to complexity when they are instructed with a quality focus. However, these more complex decisions are bought at the price of longer decision times. When a time focus is instructed or no focus is stressed, state-oriented players show poorer complexity (direct goal attempt) and poorer quality of their decisions (accuracy according to experts ratings). In a second study Roth and Strang (1994) put sports students under physical demands (bicycle ergometer). Under resting conditions state-oriented students showed more complex decisions with higher quality than action-oriented individuals. However, their disadvantage was the decrease in time spent for the decision process. At high work loads no advantages could be found for state-oriented students.

All in all, athletes who are able to regulate positive affect (action orientation) are more efficient when exposed to psychological or physiological stress. Compared to individuals with low ability to regulate positive affect they show clear advantages concerning time spent on the decisions as well as concerning the quality of the decision. Athletes low on affect regulation ability depend much more on the situation (e.g. instruction).

Similar findings were made by Raab and Johnson (2004). They exposed participants to video sequences of a basketball game. Participants then had to decide whether to shoot the ball to the basket or pass the ball to another player. In line with Roth and Strang (1994), players highly able to regulate affect more often shoot to the basket (which represents the riskier decision in the experiment) and were quicker at making decisions while athletes with lower affect regulation ability more often passed the ball to the playmaker. Beside this replication of the results by Roth and Strang, it was stated that action-oriented players (high affect regulation ability) show a tendency (initial preference) to take risky decisions on court. In comparison, state-oriented players prefer safe decisions on the basketball court.

Beckmann and Kellmann (2004) examined the self-regulatory effects of affect regulation on recovery and stress of junior rowers as well as students who are interested in sports. They could show that the ability to regulate positive as well as negative affect is positively related to recovery. At the same time low affect regulation abilities (state-orientation) are positively correlated with stress variables.

Finally, the development of self-regulatory skills or affect regulation abilities can also be influenced by the processes of sport and exercise. For example, Castanier, Le Scanff, and Woodman (2011) just recently illustrated that high-risk sports like mountaineering can reduce negative affect and anxiety. They conclude that risk-taking helps individuals to escape from self-awareness. Thus, mountaineering serves an affect regulatory function for these individuals. Also Elbe, Szymanski, and Beckmann (2005) stress the self-regulatory effect of sport. In their longitudinal study on the development

of self-regulation and affect regulation skills they could show that young elite athletes benefit from their sports participation. They compared adolescents in regular schools and in elite sport schools. It was found that elite athletes developed more positive self-optimization skills than regular students within a five-year period from age 12 to 16.

Critical Situations

Critical Situations in Sports

Critical situations within sports have been of interest in different areas of motivational research for instance as goal disengagement (Brandstätter, 2003), or distractions from effective goal striving (Gröpel & Kuhl, 2009). In sport psychology and motor performance critical situations were directly adapted from traditional notions of stress, anxiety (Hackfort & Spielberger, 1989; Lazarus & Folkman, 1984; Martens, Vealey, & Burton, 1990), and arousal (Bar-Eli & Tenenbaum, 1989; Krohne & Hindel, 1988; Martens, et al., 1990).

In the domain of sport psychology the concept of critical situations is often discussed from the perspective of the transactional model of stress and coping (Lazarus & Folkman, 1984), i.e. Spielberger's (Hackfort & Spielberger, 1989; Martens, et al., 1990) concept of state and trait anxiety as well as Hanin's (1980) proposed individual zone of optimal functioning (IZOF), and the Yerkes-Dodson Law (Yerkes & Dodson, 1908). However, Landers and Arent (2006) argued that arousal must be differentiated from the concepts of stress and anxiety. From Carlstedt's (2004a) point of view, concepts like anxiety, attention, or cognition as, e.g., in the IZOF theory (Hanin, 1980), are secondary lower order variables because they have not been proven to impact sports performance. Instead, underlying neurophysiological functions that can be measured by

brain hemispheric activation, heart rate variability, or skin conductance are primary higher order variables that influence anxiety, attention, or cognition (Carlstedt, 2004a). It still needs to be considered that studies on arousal (Arent & Landers, 2003) and cognitive anxiety (Krane, Joyce, & Rafeld, 1994) have shown to explain more variance than those on somatic anxiety. Furthermore, different sports need different arousal levels. Landers and Harris (2006) for example advocate specific arousal levels for, e.g., basketball (medium), or tennis (some arousal). *Arousal* refers to an energizing function that is responsible for guarding the body's resources for intense activity and does not direct behavior automatically. In contrast, anxiety and negative stress (distress) steer behavior into a negative direction (p. 261). Figure 1.4 gives an overview of the relationship of the concepts.

Physiological Basis. From a physiological point of view the body tries to defend its equilibrium in order to be able to perform goal-directed behavior (Selye, 1956). Hormonal (Dickerson & Kemeny, 2004) and metabolic stress symptoms then become active (Ellis, Jackson, & Boyce, 2006). The amygdala activates the sympathetic nervous system and discharges the catecholamines adrenaline and noradrenaline into the bloodstream. The catecholamines then initiate cortisol output (Krahenbuhl, 1975). These pathways are activated immediately after the first emotional reaction (see Figure 1.5). Among other bodily functions, the autonomic nervous system's indicators like heart rate, muscle tension, or skin conductivity increase. With some time delay worry or fear become present in the cerebral cortex and are analyzed as to their relevance (threat). If the analysis turns out to be negative a "fear-sign" is sent from the prefrontal cortex to the amygdala, which again sends out the signals to the sympathetic nervous system, which in turn can increase the stress reaction. If conscious awareness of the problem is added as well, the psychological disregulation of worry can again increase stress. When arousal levels become extremely high, unpleasant emotional reactions

are associated, referred to as stress or state anxiety (Selye, 1950). State anxiety according to Spielberger (1972) fluctuates over time while trait anxiety is a relatively stable behavioral disposition. Although trait anxious athletes are more likely to experience increased levels of state anxiety, the focus for critical situations will be on state anxiety or heightened levels of arousal. High levels of arousal can also be manifest in disadvantageous forms of stress.

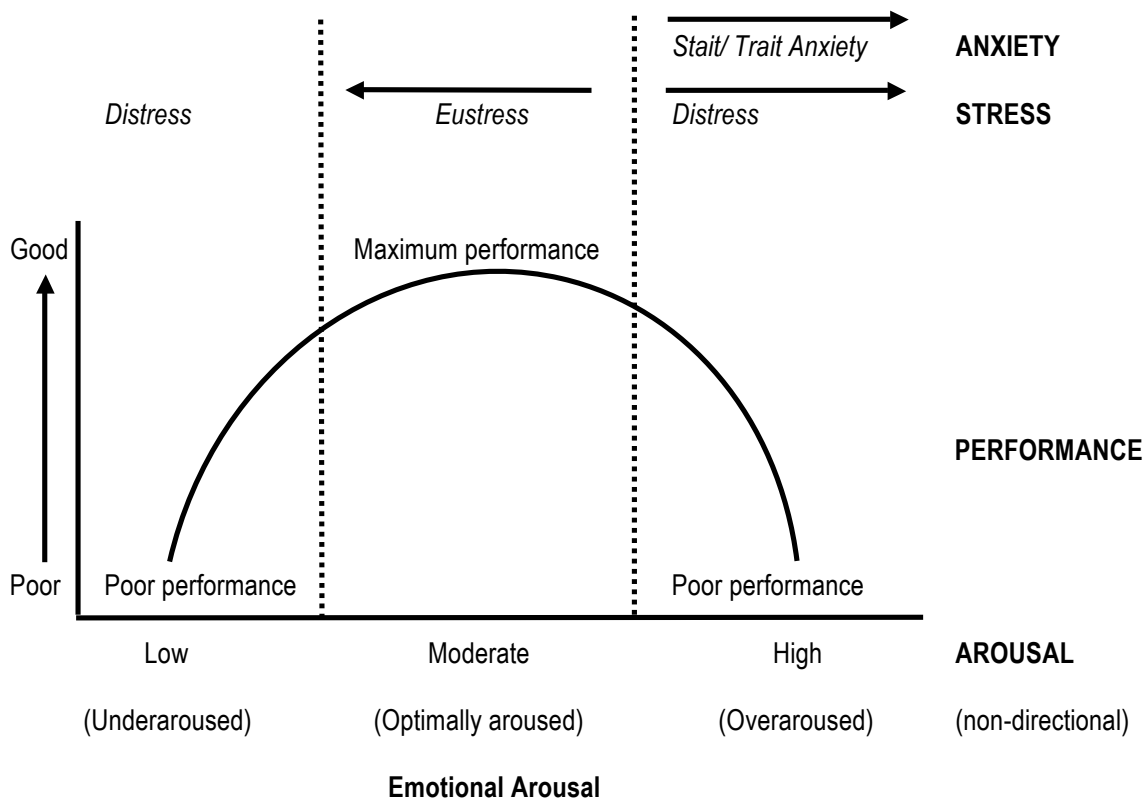


Figure 1.4 Direction of behavior and relations between arousal, anxiety, and stress (modified from Landers & Arent, 2006)

Cognitive Appraisal. An athlete will feel stressed when his cognitive appraisal of the situation is negative. Starting with the cognitive appraisal a person will experience negative mental and somatic responses. Lazarus and Folkman (1984) put forth cognitive appraisal as part of the transactional process of psychological stress – a relational interaction between individual resources and environmental stressors. Psychological

stress is defined as a particular relationship between the person and the environment being appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being (Lazarus & Folkman, 1984). They suggest two stages of appraisal: *Primary appraisal* is the initial interpretation of whether the situation is stress-evoking, i.e. challenging, threatening, or damaging. Situations are perceived as stressing under circumstances of *novelty*, *non-predictability*, *event uncertainty*, *bad timing* (imminence, duration, uncertainty), and *ambiguity*. Within the *secondary appraisal*, the athlete evaluates whether the stressor exceeds his resources for coping with the stressor. In doing so he takes into account his own potentials as well as external factors like the opponent's abilities or other situational circumstances. In this respect an athlete is *consciously aware* of stress as defined by Lazarus and Folkman (1984) and can evaluate how *subjectively* stressful a certain situations is for him or her.

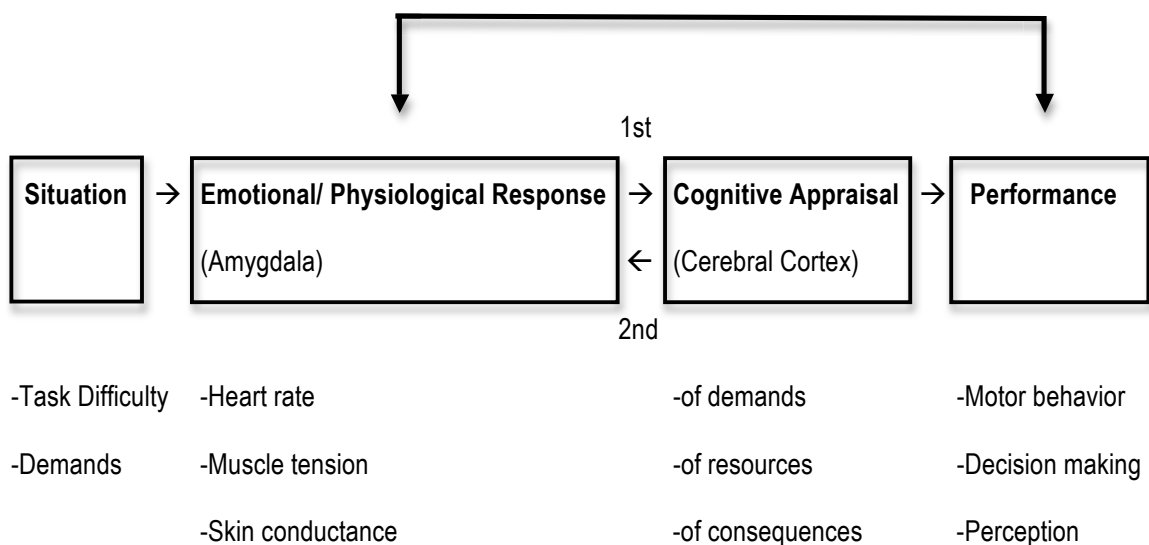


Figure 1.5 A model illustrating factors that affect the arousal-performance relationship (taken from Landers & Arent, 2006). In the original figure, the athlete with his skills, fitness, and personal experience was included as a starting point.

Definitions of Crisis in Sports. While for Lazarus and Folkman (1984) crises are “daily hassles”, authors like Filip and Aymanns (2010) or Ulich (1987) deal with the subject of crisis and critical life situations in more detail. For them a *crisis* is a temporal, stressful, and open process of change that disturbs the continuity of perception and behavior or the balance between person and environment. Thus, critical events are threats and put stress on someone beyond the barriers of his capacity. They lead to emotional destabilization and the loss of action orientation. For this reason the term crisis may be questionable in the context of sports competition.

A crisis can also be perceived as a disengagement from set goals accompanied by thoughts about benefits and costs of goal attainment (Brandstätter, 2003). Brandstätter found more of these kinds of thoughts for women with lower goal commitment and less persistent behavior on goal pursuit. Tying into this concept of crisis, Schüller and Langens (2007) identified a critical situation in competition at Kilometer 30 in a study of marathon running. At that point in the race the disengagement impulse⁶ is strongest and athletes are more intensely assessing the costs of running farther against the benefits of stopping the race. Athletes who used self-verbalization in this study were more successful in terms of running speed.

Bar-Eli and Tenenbaum (1989) potentially contributed to the research on critical situations in competitive sport. They state that athletes experience *psychological performance crises* when the stress in a competition raises arousal to an extreme level. In accordance with Filipp and Aymanns (2010) they assume that this leads to deviation from the psychological equilibrium so that the athlete can no longer optimally control his behavior. If deviations from the psychological equilibrium are too *frequent* and too *intense* this may indicate a psychological crisis (Bar-Eli & Tenenbaum, 1988). Hackfort (Hackfort & Spielberger, 1989) divides the competitive psychological crisis into three

⁶ The disengagement impulse was measured by a self-report after the marathon race. On a 7-point scale, participants were asked to what extent they felt the impulse to give up at Kilometer 10, 20, 30 and 40 (Schüller & Langens, 2007).

phases: In the first phase, *stability*, adjustments to small disturbances are still possible. Within the second phase, *lability*, accumulated dysfunctions occur. And in the third phase, *crisis*, extraordinary efforts need to be made in order to restabilize or finally collapse. The concept of competitive psychological crisis was examined for different sports like tennis (Bar-Eli, Taoz, Levy-Kolker, & Tenenbaum, 1992), basketball (Bar-Eli & Tractinsky, 2000), handball (Bar-Eli, Tenenbaum, & Elbaz, 1990), and softball (Krane, et al., 1994). Among typical stressors identified for competitive sports are *time and score*, *complexity of the task* (Krohne & Hindel, 1988), *rule- and norm-violations*, as well as *social factors* (like team mates or spectators; Bar-Eli, Levy-Kolker, Pie, & Tenenbaum, 1995). However, from this operationalization⁷ of critical situations it cannot be deduced whether an athlete is consciously aware of a critical situation (subjective criticality) or not (objective criticality).

Another perspective on critical situations in sports was put forward by Carlstedt (2004a). For him, *critical moments* are “pivotal to the outcome of a competition” and test athletes’ “control over mind-body processes” and their “ability to perform their best when it counts the most” (p. 13). Examples may be break points against a good service in tennis, or free throws in basketball, in a deciding moment of the game⁸. Although, this definition is quite imprecise, Carlstedt’s (2004a) operationalization of critical moments does not involve the player’s awareness of the situation. Insofar, critical moments are here primarily defined by the outcome orientation. Since the athlete’s perspective is not considered in this definition it remains unclear whether a situation is objectively or subjectively critical.

⁷ In basketball for example critical situations are defined as the last five minutes of the game (time) when the score difference between the competing teams is less than six points (score).

⁸ A criticality weight index is used to rate the criticality of a situation (1...least critical, 5...most critical). This operationalization of critical situations is costly because the evaluations have to be performed by experts.

Moderating Variables. Several authors have examined personality variables that may attenuate the detrimental effect of critical situations on performance or may influence the perception of critical situations. Most of these moderating variables can be associated with the ability to regulate positive or negative affect. To Carlstedt (2004a) for example athletes who are able to suppress negative influences are the best sport performers (p. 13). Carlstedt's ideas are transferred from the high-risk model of threat perception (HRMTP) by Wickramasekera (1988) who assumes that perception of threat is determined by the interaction of *neuroticism* (cf. inability to regulate negative affect) and *repressive coping* (cf. ability to upregulate positive affect). It is assumed that high levels of neuroticism lead to reduced compensation of stress⁹ (Carlstedt, 2004a). Carlstedt (2004a) found that athletes low in neuroticism (cf. state orientation) and high in repressive coping (cf. action orientation) tend to ignore implicit stress signs. In contrast, athletes high in neuroticism and high in repressive coping explicitly defend against overt signs of stress¹⁰ (Carlstedt, 2004a, p. 34). He proposed that making unconscious fears conscious (like fear of big points in tennis) may be a relief of psychological distress (Carlstedt, 2004a).

Gaudreau, Blondin, and Lapierre (2002) as well as Cerin, Szabo, Hunt, and Williams (2000) followed the idea of temporal patterning of emotions within sports competition. They documented changes in positive and negative affect prior and after competition and related these changes to different coping strategies. Gaudreau and colleagues found that affect levels changed over time only in athletes with medium or high

⁹ These maladaptive features of negative affect have previously been reported by tennis practitioners like Gallwey (1974).

¹⁰ In a single case study longer heart rate deceleration times could be shown for a tennis player winning a match compared to when losing (Carlstedt, 2002). Within Carlstedt's study, heart rate deceleration also appeared at a high level of heart rate (about 150 bpm). That is why heart rate effects of stress control can also be shown in naturalistic settings.

performance-goal discrepancies. Both research teams point to the fact that little is known so far about the influence of personality factors (like motivation, e.g., fear of failure) on the experience of positive and negative affect in and after competition.

Lazarus (1991a) and Mischel (1973) suggest that personality factors have an impact on the perception of stressful situations as critical. For example, high *extraversion* (cf. high positive affect regulation) and low *trait anxiety* (cf. low negative affect regulation) (Arent & Landers, 2003), high *levels of skill*, and optimal *arousal* have been documented to facilitate coping (Mahoney, 1979). That is why the present research examines the influence of the ability to regulate affect on the performance in critical situations. The strength of the present research lies in the integrative analysis of the impact of personality factors and situational circumstances on performance in real competitions of professional athletes.

Unconsciously Critical Situations

Unconsciousness. The present research assumes that an athlete may not be aware of a critical situation. The following chapter will deal with that topic. For Kuhl (2010), a person will gain higher consciousness of a certain object when several information processing systems have access to a mental representation (pp. 542-543), or the information is reflected between different systems (re-entrant processing; Edelman, 1989; Edelman & Tononi, 2000). By means of these system interactions possible difficulties may be resolved more easily. These assumptions are also present in the global workspace theory (Baars, 1988, 2003) which assumes representations of an object in different brain areas that otherwise function separately. For Kuhl (2010) *primary consciousness* is awareness of perception; *secondary consciousness*, however, is a form of self-experience (dialectic definition; p. 309). Hence Kuhl (2010) considers the rather philosophical definition of secondary consciousness as more relevant for personality

psychology (p. 310). This higher form of consciousness is comprised of three abilities: (1) the reflection of what is perceived, (2) remembering the conscious content, and (3) the appraisal regarding the personal relevance. In many ways, the concept of secondary consciousness is for Kuhl (2001, p. 630) similar to Freud's (1920) system of the fore-conscious. In this system, objects are "stored" for the time being that already entered consciousness or may be conscious but are suppressed (p. 256). For the studies included in this work, first of all, the primary definition of (un)consciousness is of relevance for categorizing match situations according to the athletes' level of awareness. The secondary definition, in contrast, is of importance when it comes to processing unconscious stress, optimally. For example, congruence between explicit and implicit motives represents a higher form of consciousness for the area of motives (J. Kuhl, 2010, p. 315).

Concerning the definition of *unconsciousness*, authors like Bargh (1994, p. 7) assume that a person 1) may perceive a stimulus *subliminally* and thus be unaware of the stimulus, 2) may be unaware of how a certain stimulus is *interpreted* and *categorized*, and 3) may be unaware of the influence the stimulus exerts on the person (*misattribution*). For the research question at hand effects like misattribution, subliminality, mood, and social perception are certainly of special interest (e.g., Anderson & Cole, 1990; Erber, 1991; Forgas & Bower, 1987). Subliminality for example could be shown to have an impact on peoples' judgments and behavior¹¹ (Bargh, 1992; Greenwald, 1992). Several authors were able to demonstrate that subliminal perception of stimuli that relate to a certain trait (e.g. hostility, shyness, or kindness) lead to increased activation of the trait (e.g., Bargh, et al., 1996; Devine, 1989; Higgins, 1989). Moreover, a classic finding by Zajonc and colleagues is that stimuli that have been presented to the participant more often are better liked than those presented less fre-

¹¹ Subliminal stimuli often are too weak and too brief to influence behavior (Bargh & Morsella, 2008). As such, subliminality is unconsciousness but on a least pronounced level of perception.

quently (cf. Kunst-Wilson & Zajonc, 1980; Zajonc, 2000). However, comparable results have been achieved even when the stimulus was supraliminally presented but participants were not aware of the influence the stimulus has (Crusco & Wetzel, 1984; Higgins & King, 1981; Niedenthal & Cantor, 1986). Thirdly, a person may be unaware of the influence a stimulus exerts on a person's behavior (Nisbett & Wilson, 1977). For instance, a person may misattribute the cause for a current mood state to whatever the person thinks is a reasonable cause within his or her environment (e.g., Schwarz & Clore, 1983). Bargh (1994) thus concludes that awareness of a stimulus does not matter as long as the person is unaware of the influence of the stimulus (p.12). Meaning it is only important whether or not an athlete is *aware of the influence of a stimulus (unintentional actions)*. This line of argument is in accordance with traditional views that almost all stimuli are supraliminal but a person may not be aware of them for example because of suppression (Freud, 1915a, 1915b). That is why the unconscious mind for Bargh and Morsella (2008) is the rule and not the exception (p. 78). In contrast, conscious processing for Bargh and Morsella (2008) is *intentional, controllable, serial, and accessible* (see paragraph on dual-system models in social psychology).

Other authors claim that awareness of certain aspects or relevant contents already fulfills the condition of consciousness (Dijksterhuis & Aarts, 2010, p. 471). For them consciousness includes the ability to verbalize or to be aware of certain objects and goals (Dijksterhuis & Aarts, 2010, p. 468). In this regard the concepts of attention and awareness must be carefully dissociated. There is a significant difference between perception without attention and perception without awareness (Greenwald, 1992). Yet, the unconscious is far from being "dumb" (Greenwald, 1992; Loftus & Klinger, 1992); a notion that rather refers to a system called intuitive behavior control (IBC) which hosts reflexes and automatisms (J. Kuhl, 2000a). The unconscious in the sense of Bargh (1994), Dijksterhuis and Aarts' (2010) as well as Kuhl (2000a) is much smarter. It is rather equivalent to Kuhl's (2000a) concept of the sophisticated extension memory

(EM), of whose processing a person may not be consciously aware. However, the unconscious is perception without awareness (consciousness) but not perception without attention. Attention¹² and consciousness¹³, namely, are two distinct brain processes (Koch & Tsuchiya, 2007). Attention only assures that certain information will be selected. Still, objects that are subliminally presented could be attended to but a person may not be aware of them. In the present research, Bargh's (1994) definition of the unconscious will be followed (1994). Thus, an object will not be called conscious unless an athlete is aware of the object (e.g., a critical situation) and is able to identify the influence of this object.

As can be seen in the method sections within the three studies conducted in real sport settings, it can be assumed that subjects are aware of the potential impact of critical situations on their perception and performance when they are able to verbalize these situations in an interview (subjective critical situations; Study One). However, if the athlete is not able to connect the concept of criticality with certain potential situations within a match he will not verbalize the potential situation as critical. Such a situation is hence coded an unconsciously critical situation. Objectively critical situations, as

¹² Attention selects information that is currently of relevance to the organism while irrelevant information will be left unattended or is neglected (Koch & Tsuchiya, 2007, p. 16). In this way it is biased toward selecting information in favor of the goal achievement by helping to orient and alert in service of a certain behavior (Dijksterhuis & Aarts, 2010). An example for attention without consciousness is a person looking at the lower left corner of a computer screen (attending) in which an image is hidden from conscious awareness – e.g., hidden through flashes (Jiang, Costello, Fang, Huang, & He, 2006). Most of the time attention is a prerequisite of consciousness. Still both processes are independent of each other (Dijksterhuis & Aarts, 2010). Attention – turn toward an object.

¹³ Through consciousness information relevant to the person and the person's environment will be summarized. Processes of planning, perception of incongruence, decision making, language, rational thought may access this summary of information (Koch & Tsuchiya, 2007, p. 17). For example subjects who focus on an object in the upper right corner of a computer screen are able to be consciously aware of the familiarity of a face presented in the lower left corner, even though they did not pay attention to it (Reddy, Reddy, & Koch, 2006). Wegner and Smart (1997) also applied the 2 × 2 taxonomy claiming that activation (usually high attention plus high consciousness) could also be deep (high attention but no consciousness) or superficial (no attention, high consciousness). Consciousness – being able to verbalize an object.

defined within racquet sports (Study Three), are assumed to be without awareness and thus unconscious when subjectively critical situations are excluded.

Unconscious Volition. Although the act of will was for a long time strongly connected to conscious intentions, researchers have recently found evidence for unconscious volition. Brain potentials for initiating a certain movement were present up to ten seconds before a conscious decision/ intention was formed (Libet, Gleason, Wright, & Pearl, 1983; Soon, Brass, Heinze, & Haynes, 2008). Dijksterhuis and Aarts (2010, p. 469) conclude that a person only became aware of a goal or behavior when they unconsciously decided to engage in the behavior (cf. Bargh, et al., 2001; Lakin & Chartrand, 2003).

To Dijksterhuis and Aarts (2010) goal pursuit can work as an unconscious process. For instance, when a certain behavior becomes unconsciously associated with positive affect (priming) people not only perform better in a delay task but also prefer to engage in the primed task when given the choice (cf. Bargh & Gollwitzer, 1994; Custers & Aarts, 2005). In their opinion goal pursuit is mainly dependent on goals and attention. Goal pursuit thus is a function of focus and flexibility. By *focus* (goal realization) the ability to keep a certain information/ goal active is meant (cf. Gollwitzer, 1999). *Flexibility* (e.g., impulse control) refers to the ability to respond to changing circumstances in order to pursue a goal (Dijksterhuis & Aarts, 2010, p. 471). Furthermore, Dijksterhuis and Aarts claim that a misbalance between focus and flexibility could be resolved by consciously remembering set goals. When focus and flexibility are balanced, however, being intensively reminded of one's goals (normative pressure) could disturb goal pursuit (Bongers, Dijksterhuis, & Spears, 2009; Norman & Shallice, 1986). This could be shown for professionals who were asked to pay conscious attention to a certain skill they possessed (Beilock & Gray, 2007; Lewis & Linder, 1997). The balance between these two functions seems to be achieved through activation of posi-

tive affect¹⁴ and dopamine release in the prefrontal cortex (e.g., Berridge, 2007; Dreisbach & Goschke, 2004; Müller, et al., 2007). Neuroanatomically, unconscious goal pursuit works since goals are part of a neural network in which not only the goal is represented but also objects (actions, procedures, situations, contexts) that will aid goal attainment (Aarts & Dijksterhuis, 2000; Bargh & Gollwitzer, 1994; Kruglanski, et al., 2002). Unconscious processes of goal pursuit even relate to the area of inhibition of conflicting goals – people will automatically shield goals from possible distractors (see Aarts, et al., 2007; Shah, Friedmann, & Kruglanski, 2002). Thus, once one piece of the network becomes primed all the other aspects will be activated automatically. Connections to the field of sports can be made from research on habits (Aarts & Dijksterhuis, 2000; Bargh, 1990; Shah, 2003). In this research, it could be shown that an unconscious presentation of a goal (like winning a match) can activate all means necessary to attain that goal but only when frequently performed in the past (Dijksterhuis & Aarts, 2010). Involved in this process are the prefrontal and the anterior cingulate cortex as well as the posterior cortex (see Haggard, 2008). It becomes obvious that conscious and unconscious goals draw on the same functional brain resources (e.g., Aarts, 2007; Hassin, et al., 2009).

Unconscious Stress. In stressful situations some persons' ability for self-regulation may be impaired (J. Kuhl, 2001, p. 758). Kuhl assumes this impairment to be a function of the person's predisposition for stress compensation (e.g. the degree of state orientation) and the actual stress intensity. Persons/ athletes who are able to activate positive affect (extenuation) benefit at lower levels of stress while those who are able to reduce negative affect benefit at high levels of stress (action orientation). Both coping strategies use more holistic forms of stress regulation (J. Kuhl, 2001, p. 525). In contrast state-oriented approaches like suppression and distraction display more holis-

¹⁴ See connections to Kuhl's (2000a) model: Positive affect enables realization of goals but also down-regulation of negative affect, and, thus, access to extension memory.

tic coping at low to medium levels of stress. In line with this argument, Metcalfe and Mischel (1999) put forward assumptions on the dominance of implicit and explicit ways of information processing under stress. Within their model the cool (explicit) system shows high levels of activation under low or medium levels of stress. However, activation of the hot (implicit) system increases when stress exceeds medium levels. Applying these findings to the model displayed in Figure 1.4 leads to the assumptions illustrated in Figure 1.6. Under low and high levels of arousal/ stress implicit processes are assumed to guide behavior toward good performance. However, at moderate levels of arousal, good performance is rather influenced by explicit information processes. This effect could not only be found in the area of social judgment and perception (Baron, 2000; Baumeister & Heatherton, 1996; Lambert, et al., 2003) but was also claimed by other theorists on dual processing (see Strack & Deutsch, 2004, p. 223). Furthermore, Kuhl (2010) proposes that interactions between different processing types – like congruence between explicit and implicit motives – may help to resolve extremely difficult situations (secondary form of consciousness). This is made possible because the activation of different processing systems allows for different ways of problem solving (p. 314).

If performance of athletes is supposed to be discussed not only mental dispositions (e.g. state vs. action orientation) but also the level of stress consciousness is of importance. Baumann and Kuhl (2002) were able to report a difference in number of distracting thoughts for state- (explicit processing) and action-oriented (implicit processing) individuals while reading a text. In one experimental condition, negative affect was induced without participants' awareness. Within this condition, action-oriented individuals did not show any difference in distracting thought depending on whether they were in the neutral or in the negative affect condition. However, state-oriented participants were more distracted by the induction of unconscious negative affect compared to the

neutral condition. This indicates that action-oriented individuals are better able to cope with unconscious stress levels.

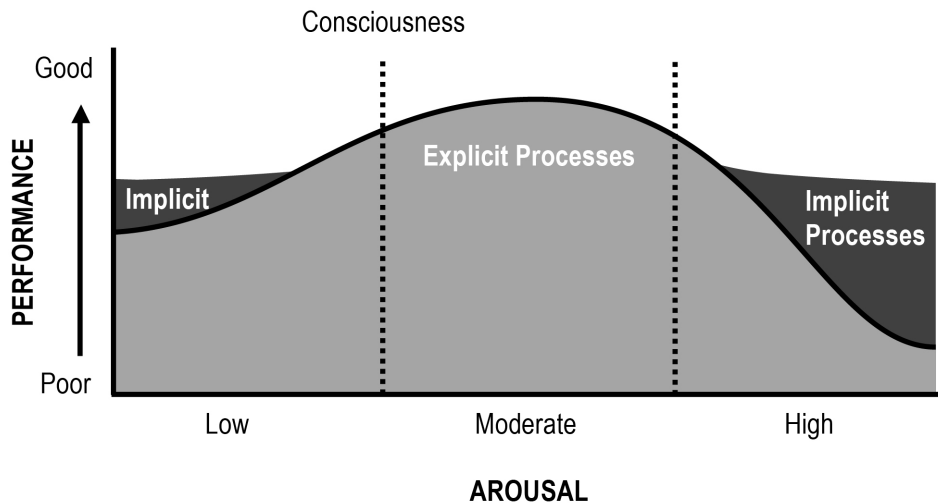


Figure 1.6 Assumption as to how explicit and implicit motivational processes affect performance under different levels of arousal (based on assumptions by Metcalfe & Mischel, 1999)

According to Kuhl (2000a, p. 144), conscious suppression of unwanted thoughts is less effective than early activation of different aspects from extension memory. Action-oriented individuals, namely, activate brain areas that are associated with extension memory well before (180-600 ms; < 800 ms) conscious processing can take place (Haschke, Tennigkeit, & Kuhl, 1994). In contrast, when participants are fully aware of their negative affect, only action-oriented individuals reporting negative affect experience increases in distracting thoughts. State-oriented individuals show no difference in performance when they are consciously aware of their negative or neutral affect. In reference to Figure 1.6, this is another argument for expecting athletes who preferably process information implicitly to perform better when they are not consciously aware of negative affect (low arousal/ stress). In contrast, athletes who prefer explicit information processing should at least not experience any performance slumps

when they are consciously confronted with stress/ arousal (at a moderate level). For the scope of the present work this means that implicit processing should result in better athletic performance when stress is not conscious. In contrast, explicit processing should enhance athletic performance when stress levels are conscious.

Further explanations of the effects reported by Baumann and Kuhl (2002) can be found in research on consciousness of positive and negative affect. To Zajonc (2000), nonconscious negative affect (e.g. induced by subliminal presentation of angry faces) leaves a person in a state of free-floating anxiety in which the person does not know what she is afraid of (p. 48-49). Downregulation of such negative affect states can be realized by reactive upregulation of implicit positive affect of which a person may not be aware. This kind of regulation is more holistic; an implicit processing with inclusion of the self (Quirin, et al., 2011). Quirin, Kazén, Rohrman, and Kuhl (2009) were able to show that an implicit measure of positive affect (IPANAT; Quirin, Kazén, & Kuhl, 2009) is negatively associated with cortisol levels as a measure of stress. Accordingly, other authors found that facial expressions of positive affect (rather implicit) help readjust cardiovascular arousal levels at negative affect states (Fredrickson & Levenson, 1998). Especially when in the past, positive and negative affect have been interconnected within the self, action-oriented individuals will be better able to regulate affect (Jostmann, et al., 2005; Koole & Jostmann, 2004). The findings of Quirin and colleagues suggest that implicit regulation of positive affect is more adaptive a regulation mechanism than explicit affect regulation (Quirin, et al., 2011). Furthermore, Zajonc's (2000) research findings support the assumption that unconscious stress can be more severe when an athlete was seldom confronted with a stressful situation and circumstances do not support positive affect. Results of Zajonc's (2000) research group suggest that mere exposure to stimulus (of whose meaning the participant is unaware) as well as unconscious positive priming enhance positive affect.

Conclusion. Many times, studies on critical situations in sports do not take into account whether their notion of critical situations is aligned with the athlete's awareness of the criticality of the situation or primarily with the performance outcome. As such, these studies leave open whether they investigate subjective or objective critical situations. For the thesis at hand, it makes a difference whether an athlete is aware of the criticality of the situation (because of high intensity or certain personality variables) or not. It is assumed that awareness of the criticality of a situation triggers different personality variables (explicit) compared to critical situations in which awareness is not present (implicit).

Definitions of stress are sometimes misleading since it is not clear whether subjective awareness is assumed or the term stress only refers to a negative load for an athlete. For the present work, the term *arousal* better represents the seamless, continuous transition of mental loads on the athlete. This way, it is possible to make assumptions as to the development of performance at low (under-arousal), medium (optimum), or high levels of arousal (over-arousal). Explicit motivational processes may accordingly be supportive when critical situations are subjectively represented and arousal levels are at an optimum. However, when athletes are not consciously aware of critical situations because of low arousal intensity or respective personality traits, implicit motivational processes may predict performance better than explicit processes.

Ecological Validity

The present work did not experimentally manipulate variables in a laboratory. Instead, the aim was to explore the generalizability of experimental findings from the field of personality and motivational psychology in the naturalistic setting of high performance sport (cf. Elliot & Church, 1997, p. 219). As such, performance outcomes

were assessed from entire seasons in tennis, table tennis, badminton, and basketball, the whole career for tennis as well as entire single matches. All these measures of performance were recorded while athletes still played within the highest German leagues (Bundesliga). This means all athletes performed at an elite level.

Experimental psychology has been aware of the dangers of controlled laboratory settings from the beginning. Brunswik (1956) went ahead and pointed to several problems including that experiments should as much as possible resemble an individual's natural environment in order to be able to observe natural behavior. He claimed that different places, different times, and different complex situations lead to different individual behavior (Tolman & Brunswik, 1935, p. 55). Thus, questions must be raised by researchers like: How natural a place is a laboratory setting for an elite athlete? To what degree do motor tasks represent the target expertise? Are there differences in certain personality traits within the sample of athletes? How many times does the behavior observed need to be tested in order to be representative of an athlete's ability?

Naturally, the aim of sport psychology for competitive sports is to help athletes perform better in a clearly defined competitive settings. Research on action vs. state orientation (affect regulation) has well illustrated very well how difficult it is to translate laboratory findings into real sport settings. Most studies on the subject clearly propose action orientation being of advantage for being under pressure (e.g., Beckmann & Kazén-Saad, 1991; Heckhausen & Strang, 1988; Roth & Strang, 1994). However, research outside the laboratory sometimes comes to different conclusions (J. Kuhl & Koch, 1984; Mempel, Wegner, Rivera, Strang, & Knisel, 2006). In tennis for example, athletes' competitive performance under stress might be impaired as a function of their ability to regulate affect (state orientation). It needs to be considered in practical research on the topic that different sports have different demands. Even within one and the same sport different playing positions (guard vs. center in basketball) or different

tasks (shooting vs. skiing in biathlon) require different technical, physiological, and mental abilities.

Consequently, in several areas of research in sports science the importance of ecological validity has been stressed. Psychophysiological responses to stressors for example may well vary in the laboratory and in real life. This was not only claimed by practical sport psychologists (e.g., Carlstedt, 2002) but also by researchers in psychophysiology (e.g., van Doornen, Knol, Willemsen, & de Geus, 1994; van Doornen & van Blokland, 1992). In psychophysiological (cardiovascular) research, findings may differ depending on the setting a person is confronted with. Thus, in contrast to laboratory experiments, a free-moving individual will be continuously physiologically monitored in everyday life settings (Fahrenberg, 1996).

Questioning experimental settings concerning their ecological validity is also common for researchers in the area of decision-making in sport (e.g., Helsen & Pauwels, 1993; Williams, Davids, Burwitz, & Williams, 1993). Respectively, these researchers point out that typical laboratory settings seeking application for the sports domain need additional steps to transfer laboratory findings from very restricted setting to more externally valid settings (cf. Raab, 2002) in order to gain more ecological validity. Even if an experiment on decision-making for example includes typical scenes from the target team sport (e.g., basketball) the real game situation may still result in different effects due to different physical distances between players and ball, or different sizes of player and ball (Raab, 2003).

Hypotheses

The strength of the present research lies in the integrative analysis of the impact of personality factors and situational circumstances on performance in real competitions of professional athletes. The first two studies focus on the effects of implicit and explicit processes of affect regulation. In study one, this effect is examined for professional tennis players in *subjective* critical situations, of which participants are consciously aware. In study two, professional basketball players participated. Critical situations in this study are *objectively* set. That means, instead of asking players for subjective criticality an objective definition of critical situations is used. Within the first two hypotheses, it is assumed that a specific stimulus situation is an incentive for the respective information processing system.

Hypothesis One: Athletes who process affects/ motives explicitly (state orientation, explicit motives) perform better in consciously (subjective) critical situations. These situations not only include excerpts of the single matches recorded but also tie-break records for entire seasons, several years, or the entire career.

Hypothesis Two: Athletes who process affects/ motives implicitly (action-orientation, implicit motives) perform better in unconsciously critical situations.

In the third study, the focus is shifted over to alternative explanations of behavior from the dissociation of two motivational systems: explicit vs. implicit. Furthermore, a more precise operational definition of criticality depending on the athlete's consciousness is applied. *Unconsciously* critical situations are operationally defined in the third study as objectively critical situations that athletes are, at the same time, not consciously aware of. Thus, hypothesis one and two are applicable for the third study as

well. However, explicit vs. implicit *motives* predict performance in consciously and unconsciously critical situations, respectively. Moreover, implicit motives as well as congruence between implicit and explicit motives are assumed to predict long-term sports performance (including competition outcomes, and amount of practice hours).

Hypothesis Three: Long-term performance results of athletic competition (Study One: ATP ranking, progress in ATP ranking; Study Two: season statistics; Study Three: four-years percentage of tie-breaks and matches won) as well as the amount of practice hours are better predicted by including implicit information processes (motives, affect regulation) than by explicit motives alone.

Hypothesis Four: Long-term performance results of athletic competition (four-years percentage of tie-breaks and matches won) as well as the amount of practice hours are better predicted by a congruence of implicit and explicit information processes. When motives are not congruent a high ability for affect regulation is beneficial.

Moreover the power motive is assessed in addition to the achievement motive in study three. In racquet sports, it is assumed that the power motive is associated with performance outcomes, which is why hypothesis four is formulated.

Hypothesis Five: The implicit power motive is additionally able to predict performance outcomes in racquet sports.

STUDY 1: AFFECT REGULATION OF ELITE TENNIS PLAYERS IN CONSCIOUSLY CRITICAL SITUATIONS

It is hypothesized that explicitly processing athletes perform better in critical situations of which they are subjectively aware (conscious). On the one hand, it is assumed that when athletes are aware of critical situations persons who usually consciously process stress (explicit information processing) experience advantages. On the other hand, tennis is a highly strategic game (McPherson, 2000) in which activation of the intention memory in critical situations of the match may be beneficial. In order to test this hypothesis single competitive matches were recorded and players were asked for subjective critical situations they experienced over the course of the match. Furthermore, career data on overall match and tie-break performance was analyzed along with statistics on their best ATP ranking as well as their progression from their first to the best ATP rank.

Method

Participants. 60 male professional tennis players participated in the study. Players were recruited from clubs of the German Tennis Bundesliga (Division North) and at ATP tournaments at two levels (Challenger and ITF Future). On average, they were $M = 25.5$ ($SD = 4.9$) years old. Their best ATP rank was at $Mdn = 228.5$. Players were from 14 different nations (Argentina, Australia, Brazil, Chile, Germany, Greece, Italy, Morocco, Netherlands, Austria, Romania, Sweden, Switzerland, and Spain).

Procedure. For the club players, club officials or coaches had been contacted prior to the study before athletes were informed about the study by the researchers. Players who were recruited at the tournaments were directly asked for participation at

the front desk of the tournament. All participants were introduced to the purpose of the study. After the tennis professionals gave their informed consent to participate in the study they filled out a questionnaire on the ability to regulate positive and negative affect (ACS-90). Once participants were finished, one competitive match was recorded and documented by the researchers. For this purpose a video camera was attached to the fence at one end of the court. The researcher documented all scores and prominent events or incidents of the match on a paper form. Immediately after the competition (5-10 min), an interview was conducted with the player about subjective critical situations of the match. Once the interview was finished, the player was thanked and debriefed about the real aim of the study.

Subjectively Critical Situations. In an interview after the match, tennis players were asked for critical situations they experienced during the competition. The interview lasted about 10-15 minutes. First, critical situations were defined as subjectively very important and mentally stressing situations that influenced the progression of the match noticeably. To their minds, the situation was supposed to have an impact on winning or losing a set or the whole match. Players were asked to name all the prominent situations they still remembered and determine a starting and end point for each critical situation with the help of the game score record. If players could not recall the single scores correctly they used the researcher's documentation of the score as assistance. Consequently, all rallies were either coded as non-critical or critical. Furthermore, if a critical situation ended successfully for the player, the subsequent rallies were called positive post critical. Accordingly, when a critical situation was lost the following rallies are labeled negative post critical situations. Besides critical situations on game level, tie breaks played over the course of their careers were taken as another operationalization of repeated critical situations over a longer period of time. For inferential analyses of critical situations, the number of players was reduced to 53 since not every player recorded experienced a critical situation. Furthermore, only 39 players

had either a positive or a negative post-critical situation. Finally, only 26 players experienced both positive and negative post-critical situations.

Ability to Regulate Positive and Negative Affect. Participants' ability to regulate positive and negative affect was measured by the English and German version of the Action Control Scale (Diefendorff, Hall, Lord, & Streat, 2000; J. Kuhl, 1994). The ability to regulate *positive affect* is measured by 12 dichotomous items summing up to a scale of *decision-related action-orientation*. Higher scores indicate a higher ability to regulate positive affect (higher action-orientation, AO) and preferentially implicit information processing. Low scores indicate an inability to efficiently regulate positive affect (state-orientation, SO), associated with explicit information processing. A sample item for the ability to regulate positive affect reads as follows:

When I know I must finish something soon:

(a) *I have to push myself to get started*

(b) *I find it easy to get it done and over with*

In this example, response (a) indicates a state-orientation while response (b) denotes a high ability to regulate positive affect (action-orientation). The ability to regulate *negative affect* is assessed by a 12-item scale called *failure-related action-orientation*. A high ability to regulate negative affect is reflected by a high score of failure-related action-orientation. For this scale a sample item is:

When I am told that my work has been completely unsatisfactory:

(a) *I don't let it bother me for too long*

(b) *I feel paralyzed*

Answer (a) indicates a high ability to regulate negative affect (action-orientation; implicit processing) while answer (b) is the state-oriented response (explicit processing). For each item action-oriented responses are coded 1 and state-oriented responses are coded 0. The ability to regulate affect is then measured as value between 0 and 12. Internal consistency reliabilities are documented at .74-.78 for regulation of positive

affect (AOD) and .66-.70 for regulation of negative affect (AOF) (Diefendorff, et al., 2000; J. Kuhl, 1994). In this study internal consistencies were .82 for regulation of negative affect and .82 for regulation of positive affect. Both scales were median split in order to compare high and low affect regulators.

Percentage of Points Won. On *game level*, the percentage of points won is taken as the dependent variable. The variable was calculated by dividing all points won by the number of all points played. The procedure was conducted for critical as well as non-critical situations. On the *career level*, a career percentage index was formed out of all matches won divided by all matches played. Similarly, critical situations on the career level are defined as tie breaks won divided by tie breaks played over the course of the players' career.

Career Performance. Furthermore, two variables were taken from the career statistics of the ATP homepage: The best rank of each player was used as a variable for the players' potential playing ability (*ATP Best*). Further, an index was formed to determine the players' efficiency over the course of their careers (*Ranks / Months*). First the number of ranks was calculated that players moved up from their first entry in the ATP to their best rank in the ATP. Then the period of time (in months) that the player required for this progression was determined. Finally, the number of ranks proceeded (first minus best rank) was divided by the period of time in months (first minus best date).

Design and Statistical Analyses. Two-way analyses of variance were conducted for the difference between high and low positive as well as negative affect regulators on percentages of matches, tie breaks over the career, and points won in the single match recorded. The between-subjects factor is the ability to regulate positive and negative affect (high, low). The within-subjects factor is the critical situation (non-critical, critical) for game and career statistics. Differences in mean best ATP rankings and efficiency of rank progress over time (ranks / month) are calculated using the

Mann-Whitney U-Test. Dependent variables are percentage of points won (game level) and percentage of matches, and tie breaks won (career level) as well as best rank and efficiency in ranks proceeded (career level).

Table 2.1 Means and standard deviations ($\pm SD$) for affect regulation abilities of professional tennis players and performance over their ATP careers. Medians for ATP Best and Rank / Month statistics ($N = 60$)

	Match %	Tie Break %	ATP Best	Rank / Month	Overall
Negative Affect R.					6.27 (3.42)
High	55.0 (10.4)	48.8 (9.0)	190.5	13.5	
Low	56.8 (9.1)	51.7 (15.3)	281.5	13.0	
Positive Affect R.					5.98 (3.40)
High	57.3 (9.1)*	48.0 (12.0)*	207.5	15.0	
Low	54.5 (10.2)*	52.7 (13.2)*	273.5	11.5	
Overall	55.9 (9.7)**	50.4 (12.7)**	228.5	13.0	

Note. * $p < .05$, ** $p < .01$.

Results

Descriptive Statistics

Affect Regulation. Means and standard deviations for affect regulation abilities of professional tennis players are presented in Table 2.1 above. Correlation data is included in Table 2.2. Professional tennis players of this sample showed average lev-

els of ability to regulate positive affect (decision-related action orientation) $M = 5.98$, $Mdn = 5.5$, compared to the norm sample, $Mdn = 5.5$. For the regulation of negative affect (failure-related action orientation) $M = 6.27$, $Mdn = 6$, participants showed mean scores slightly higher than the norm sample, $Mdn = 4.5$. Both scales turned out to be significantly associated.

Career Performance. In Table 2.1, career statistics of the tennis sample are presented. In addition to the median values of the players' highest ATP ranking (ATP Best), the percentage of matches (Match %), and tie breaks won (Tie Break %) at their preferred level of playing are given. Furthermore, the median values of the indices of ranks proceeded per month are given (Rank / Month). Intercorrelations can be found in Table 2.2.

Critical Situations and Tennis Performance

Career Performance. When comparing data on the level of career performance in the ATP there is a difference between the percentage of matches won and the percentage of tie breaks won. In this sample, players won 55.9% of the matches in their preferred playing division. In comparison, they only won 50.4% of all the tie breaks played in the same division, $F = 9.37$, $\eta^2 = .14$, $p < .01$. For inferential statistics, please, see Table 2.4, for descriptive statistics see Table 2.1 above.

Game Performance. No statistically significant difference was present between subjective critical situations ($M = 49.4\%$) and non-critical situations ($M = 49.2\%$). However, the difference between positive ($M = 50.8\%$) and negative post-critical situations ($M = 47.7\%$) was significant (see Table 2.3 for descriptive, Table 2.6 for inferential statistics).

Table 2.2 Correlations between positive and negative affect regulation abilities of professional tennis players and performance over their ATP careers ($N = 60$)

	2	3	4	5	6
1 Negative Affect Regulation	.58**	-.20	.05	.01	.13
2 Positive Affect Regulation		-.21†	.03	-.04	.13
3 ATP Best			-.63**	-.33**	.09
4 Match %				.19	.05
5 Tie Break %					.00
6 Rank / Month					

Note. Inter-correlation coefficients with ATP Best and Rank / Month indices are Spearman-Rho. All other correlation coefficients are according to Pearson. † $p < .10$, ** $p < .01$.

Affect Regulation and Tennis Performance

Negative Affect Regulation. As Table 2.1 illustrates, there was no difference in career performance in dependence on negative affect regulation, $F = 0.54$, $\eta^2 = .02$, $p = \text{ns}$ (MANOVA). Additionally, no difference was found for best ATP ranking, $U = 401.50$, $r = -.09$, $z = \text{ns}$, and ranks per month, $U = 431.00$, $r = -.03$, $z = \text{ns}$.

The same finding was present for the individual games. There were no differences between performances at the different game phases dependent on the ability to regulate negative affect, $F = 0.08$, $\eta^2 = .00$, $p = \text{ns}$ (MANOVA; see Table 2.3 for descriptives).

Table 2.3 Means and standard deviations ($\pm SD$) of data from 53 individual competitive matches with subjectively indicated critical situations, and positive vs. negative affect states in post critical situations ($N = 53$)

	Total	Non-Critical	Critical	Positive Post	Negative Post
Negative Affect R.					
High	50.2 (6.9)	50.2 (9.0)	50.4 (8.7)	48.6 (8.9)	47.4 (10.8)
Low	49.8 (6.6)	48.2 (6.0)	48.4 (8.4)	52.5 (10.3)	47.8 (12.8)
Positive Affect R.					
High	50.5 (6.7)	48.4 (6.7)	49.5 (7.2)	48.6 (9.7)†	49.0 (12.6)†
Low	49.5 (6.7)	49.9 (8.3)	49.3 (9.7)	53.2 (9.6)†	46.0 (10.8)†
Overall	50.0 (6.6)	49.2 (7.6)	49.4 (8.5)	50.8 (9.8)**	47.7 (11.8)**

Note. Out of 60 participants, 53 complete matches with critical situations were on hand. For 39 matches positive and for 39 matches negative post critical situations occurred. However, the number of players that experienced both post critical situations at the same time reduces $N = 26$. † $p < .10$, ** $p < .01$.

Positive Affect Regulation. When comparing individuals on their levels of ability to regulate positive affect there was no difference in the percentage of matches and tie breaks won over their careers, $F = 2.04$, $\eta^2 = .07$, $p = ns$ (MANOVA). There was also no difference for data on best ATP ranking, $U = 363.50$, $r = -.17$, $z = ns$, or the efficiency index of ranks per month, $U = 361.00$, $r = -.17$, $z = ns$. For descriptive statistics see Table 2.1.

Moreover, no differences could be found for individual game performance depending on positive affect regulation, $F = 0.05$, $\eta^2 = .00$, $p = ns$ (MANOVA).

Table 2.4 Impact of ability to regulate positive affect on tennis performance in critical situations – Match % vs. Tie Break % ($N = 60$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Positive Affect Regulation (PAR)	1	0.17	.00	.68
PAR within-group error	58	(0.02)		
Within subjects				
Tie Break	1	9.37**	.14	.00
Tie Break \times PAR	1	7.29*	.07	.05
Tie Break within-group error	58	(0.01)		

Note. Values enclosed in parentheses represent mean square errors. Tie Break denotes the comparison between regular match performance in % vs. performance in tie breaks in %. * $p < .05$, ** $p < .01$.

Affect Regulation and Tennis Performance in Critical Situations

Career Performance. The performance of players highly able to regulate positive affect was more vulnerable in tie break situations when compared to their overall ATP match performance and players less able to regulate positive affect, $F = 7.29$, $\eta^2 = .07$, $p < .05$. Their performance decreased by almost 10% (see Table 2.1 for descriptive and Table 2.4 for inferential statistics).

Table 2.5 Impact of ability to regulate positive affect on tennis performance in critical vs. non-critical situations in the single matches recorded ($N = 53$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Positive Affect Regulation (PAR)	1	0.15	.00	.70
PAR within-group error	51	(73.32)		
Within subjects				
Critical Situations (CS)	1	0.03	.00	.87
CS \times PAR	1	0.30	.01	.59
CS within-group error	53	(58.41)		

Note. Values enclosed in parentheses represent mean square errors. Tie Break denounces the difference between regular match performance in % vs. performance in tie breaks.

Game performance. When only the 26 games were tested that include critical as well as positive and negative post-critical situations there was a significant difference, $F = 3.13$, $\eta^2 = .30$, $p < .05$ (MANOVA), between high and low ability to regulate positive affect between the four situations. However, the difference in game performance was not present between non-critical vs. critical situations, $F = .30$, $\eta^2 = .01$, $p = \text{ns}$, as expected. There is a marginal significant difference between performances in positive vs. negative post-critical situations, $F = 2.89$, $\eta^2 = .11$, $p < .10$, that was non-significant after Bonferroni correction. For descriptive data see Table 2.3, inferential statistics can be found in Table 2.5 and Table 2.6, respectively.

Table 2.6 Impact of ability to regulate positive affect on tennis performance in positive vs. negative post critical situations in the single matches recorded ($N = 26$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Positive Affect Regulation (PAR)	1	0.01	.00	.93
PAR within-group error	24	(142.30)		
Within subjects				
Post Critical Situations (PCS)	1	7.71**	.24	.01
PCS \times PAR	1	2.89	.11	.10
PCS within-group error	24	(54.60)		

Note. Values enclosed in parentheses represent mean square errors. Only 26 single matches included positive as well as negative critical situations. † $p < .10$, * $p < .05$, ** $p < .01$.

Discussion

Explicit Processing in Critical Situations in Tennis. Concerning the central hypothesis for study one, results suggest partial support for the assumptions. Although it is hypothesized that explicit information processing athletes should experience advantages in subjective critical situations no such differences to implicit information processing players could be found. However, tie breaks are the culminating point of a close match. It could be assumed that tie breaks, at least in some parts, are critical situations of which athletes are subjectively aware. Yet, since the information of whether or not each player was aware of the criticality of each tie break in their respective careers is

not available to the researcher, tie breaks must be assumed to be objectively critical situations of whose criticality some athletes but not to others could be consciously aware. Nevertheless, explicit information processing athletes play tie breaks more successfully compared to implicit information processing players. Implicitly processing athletes (action orientation) decrease in their tie-break performance by almost 10% compared to regular matches. In contrast, explicit information processing athletes (state orientation) experience nearly no performance impairment. Practically every twentieth tie break is only won because of the ability to regulate positive affect. This is of interest especially because the indices of matches won within the career are not correlated to tie breaks won ($r = .19, p = ns$). Meaning that whoever is a strong player concerning overall match performance does not necessarily need to perform well in a critical situation like a tie break. Although tie break career performance is significantly related to ATP ranking ($r = -.33, p < .01$) the link between matches won over the career and ATP ranking is much stronger ($r = -.63, p < .01$). This could mean that within a tie break an ability to perform under pressure is needed which is not equally represented in regular match play. The ability to regulate positive affect – more intentional, explicit actions – could be such an ability.

In tie breaks players with high positive affect regulation ability show much more performance decreases than players low in affect regulation ability. One possible explanation is put forth by Koole, Kuhl, Jostmann, and Vohs (2005) who stated that among other advantages of a low ability to regulate affect this might lead to regression of behavior. A possible explanation for the performance increases of explicit processing athletes (low positive affect regulation) is a deterioration of the interaction between the explicit system of intention memory (IM) and the implicit, lower level intuitive behavior control (IBC). It is assumed here that behavioral automatisms saved in the IBC are well established in professional athletes and will function without much intentional guidance. In fact, explicitly processing athletes' (state orientation) behavioral routines

might be less susceptible to repeated goal changes from the IM since the interconnection is cut. Implicit processing tennis players may experience performance slumps in tie breaks because IM may try to change plans repeatedly that need to be implemented by behavioral routines (IBC). Secondly, explicitly processing athletes' exclusive focus on the IM because of increased stress may already put them at an advantage compared to implicitly processing players. This way they could thoroughly plan their playing strategy for the tie break based on information collected over the course of the set. Now, routines in the IBC must simply be activated (for example, in one of the many breaks within a competition) and executed rigidly. For example, McPherson (1994, 2000) characterizes tennis as a high strategy sport in which players constantly have to adapt their match plans. Experienced tennis players display more task relevant thoughts and more precise tactical plans (McPherson & Thomas, 1989). Consequently, explicitly processing players could benefit from focusing on intentions (IM) in tie breaks. A third explanation might be that explicit processing athletes may benefit from a "sit and wait" strategy which could be very successful in racquet sports (Koole, et al., 2005). Since tie breaks are critical situations for both players both players will experience performance impairment in these match phases. When a state-oriented player (explicit processing) restrains himself to let his opponent play the game and make mistakes he will most probably win more points.

Implicit Processing and Career Performance. In contrast to the advantage explicitly processing athletes seem to enjoy in critical situations like tie breaks, data on career performance by trend point in a different direction. At least at a descriptive level higher positive affect regulation ability (implicit processing) is associated with higher best median ATP ranking, $Mdn_{high} = 207.5$ vs. $Mdn_{low} = 273.5$, $r = -.21$, $p < .10$, and a higher median efficiency in climbing in the ranking, $Mdn_{high} = 15.0$ vs. $Mdn_{low} = 11.5$. At a career level players who can effectively put plans from intention memory (IM) into action (intuitive behavior control, IBC) seem to be more successful. Taking into consid-

eration the arguments by Beckmann and Kazén (1994), the results of the field study at hand, support the idea that in a feedback sport like tennis professionals generally seem to profit from good affect regulation abilities. Since proceeding in the ATP ranking is dependent on winning matches in important tournaments, players with a high ability to regulate positive affect seem to be efficient in picking the right tournaments and winning important matches at these tournaments. Since the correlation between positive affect regulation and best ATP ranking is at the very least low ($r = -.21$, $p < .10$) but with positive affect regulation and percentage of matches won nonexistent ($r = .03$, $p = \text{ns}$) it could be assumed that affect regulation influences success in the ATP differently. Picking the most valuable tournaments in which ATP points can be more easily gained could be one explanation.

State Orientation and Emotional Support. Finally, results of this study on performance in post critical situations replicate traditional findings of sport psychologists on the dissociation of action vs. state orientation. When state-oriented athletes (explicit processing) are in a state of positive affect (like in positive post-critical situations) they outperform action-oriented athletes (implicit processing). However, when negative affect states are present (like in negative post-critical situations) action-oriented players do not experience performance impairments like state-oriented players do. Action-oriented players are able to downregulate negative affect and effectively put goals into action.

STUDY 2: AFFECT REGULATION OF ELITE BASKETBALL PLAYERS IN OBJECTIVELY CRITICAL SITUATIONS

In contrast to study one, affect regulation processes within a team sport were analyzed in study two. This time critical situations were not subjectively determined. Instead, an approach was used that defined a critical situation by objective criteria like point differences and playing time (Bar-Eli & Tractinsky, 2000). Accordingly, the last 5 minutes of a game in which the score difference between two teams is equal or less than 9 points is taken as a critical situation. Research on basketball game statistics suggests that basketball teams benefit from high scores in *field goals*, *free throws*, and *defensive rebounds* along with low scores in *personal fouls* and *turnovers* (Hofler & Payne, 2006; Sánchez, Castellanos, & Dopico, 2007). It is assumed that basketball players with a high ability to regulate affect (implicit information processing) show advantageous statistics in the five categories of game statistics especially at the end of a close game.

Method

Participants. Fifty-six professional basketball players from the German Basketball Bundesliga participated in the study. On average players were $M = 25.9$ ($SD = 4.1$) years old. Their mean playing time per game over the course of the season was $M = 22.1$ minutes ($SD = 8.4$). Players were from 19 nations among them Australia, Bosnia-Herzegovina, Canada, Croatia, Denmark, Germany, Estonia, Finland, Greece, Iceland, Latvia, Lithuania, Nigeria, Poland, Romania, Serbia, Slovakia, Slovenia and the USA.

Procedure. Clubs' head coaches or coaching staff were contacted prior to the study. Paper questionnaires were sent to the coaches. Coaches were instructed in how

to administer the ACS-90 test to their players. They were asked to have the players fill out the questionnaire prior to a team practice in a quiet room. Coaches informed the players about the purpose of the study. Players then signed an informed consent to participate in the study. Finally, coaches sent back the questionnaires to the university. Once all play-off games had been finished and the 2004/05 season had closed, players were debriefed in written form. Performance data from 218 league games were analyzed with the help of a scouting company that serves the German Basketball Bundesliga on a regular basis. Season data on every players' performance in the categories *field goal percentage*, *free throw percentage*, *defensive rebounds*, *turnovers*, and *fouls* were taken from the German Basketball Bundesliga website. Comparisons of performance data from close games compared to games decided early were analyzed with the help of the scouting company. Data on the performance in critical vs. non-critical phases within close games was analyzed by the same scouting company. Finally, questionnaires and performance data were statistically processed.

Objectively Critical Situations. In contrast to the procedure with the tennis professionals, a critical situation was not assessed by an interview (subjective evaluation) but by objective criteria. According to Bar-Eli and Tractinsky (2000), the last five minutes of a basketball game are critical as long as the point difference between the two competing teams is between 0-6 points. For this work a more new survey was conducted among coaches of the first German Basketball Bundesliga. Most coaches proposed a point difference of 9 points as critical in the final phase of a close game. In the present study, in order to include game statistics of as many players as possible, critical situations were operationalized as the final 5 minutes of a game when the point difference between the teams was equal to or less than 9 points. At the season level, games that fulfilled these criteria were labeled *close games* ($N = 117$). Games that did not end in critical situations were labeled *decided early* ($N = 101$). Another differentiation was made between two time phases within close games: The last 5 minutes of a

close game were labeled *objectively critical*. In this research, the remaining 35 minutes were called *non-critical*.

Ability to Regulate Positive and Negative Affect. Assessment of the basketball players' ability to regulate affect was in accordance with the procedure in the tennis sample (Study One). The English or the German version of the ACS-90 was applied. The ability to regulate positive affect is measured by the subscale decision-related action-orientation (AOD). The ability to regulate negative affect is measured by the subscale failure-related action orientation (AOF). Higher scores in both subscales represent a higher ability to regulate affect (implicit processing). Internal consistencies for the ACS subscales in study two are .78 for regulation of positive affect and .71 for regulation of negative affect.

Performance Data. Five important indices normally assessed by scouting systems in the German Basketball Bundesliga were collected. The indices used are (1) the *percentages of field goals* and (2) *free throws* as well as the (3) *number of defensive rebounds*, (4) *turnovers*, and (5) *personal fouls*. In order to render individuals' game statistics comparable, all indices were put in relation to the number of individual games per season and minutes played on the court. Because of the resulting small numbers, all indices were multiplied by the factor 40. Thus, all data given in this report are statistics as if the player had played 40 minutes per game, a complete basketball game according to international rules. At the season level, statistics represented average performance over the course of the season per game. At the game level, statistics for objective critical situations were taken only from the last 5 minutes of a close game. Statistics for non-critical situations were taken from the first 35 minutes of a close game.

Design and Statistical Analyses. Performance (game statistics) of basketball players with high (implicit processing) and low (explicit processing) ability to regulate positive and negative affect (high, low) was compared between critical situations (criti-

cal, non-critical) as well as between close games and early decided games (close, decided early). Hypotheses were tested in a two-way analysis of variance.

Results

Descriptive Statistics

Affect Regulation. Descriptive statistics of abilities for affect regulation after failure (AOF) and decision making (AOD) are presented in Table 3.1. Means and standard deviations are organized by field position of the players. Overall, professional basketball players show increased levels of affect regulation compared to the norm sample. The results for affect regulation at decision making (AOD) indicate a non-significant group difference dependent on the different positions played on the field, $F = 2.90$, $\eta^2 = .10$, $p < .10$. Affect regulation values (AOD) for centers are significantly higher than those of guards, $T = 2.35$, $d = .84$, $p < .05$, but not after Bonferroni correction. Forwards show moderately high levels of affect regulation at decision-making. Their difference in mean value compared to the guard or center positions fail to display significance.

Season Performance. In Table 3.2, the players' basketball performance data for the entire season 2004/05 is displayed for five statistics: Field goal percentage, free throw percentage, number of defensive rebounds per game, number of turnovers per game as well as number of fouls per game. Table 3.3 includes the intercorrelation matrix for the season data.

Objectively Critical Situations. Traditionally, critical situations in basketball are defined as the last five minutes of a basketball game when the point difference is equal to or less than six points (Bar-Eli & Tenenbaum, 1988; Bar-Eli & Tractinsky, 2000).

Table 3.1 Means and standard deviations ($\pm SD$) for abilities to regulate affect by field position ($N = 56$)

Affect Regulation	Norm	Overall ($N = 56$)	Guards ($N = 14$)	Forward ($N = 21$)	Centers ($N = 21$)
Negative Affect Reg.	≥ 5	7.21 (2.75)	6.21 (2.89)	7.48 (2.94)	7.62 (2.40)
Positive Affect Reg.	† ≥ 6	7.93 (3.06)	6.50 (3.44)*	7.86 (3.20)	8.95 (2.29)*

Note. † $p < .10$, * $p < .05$.

Table 3.2 Means ($\pm SD$) for basketball performance data over the season depending on affect regulation ($N = 56$)

	Field Goals (%)	Free Throws (%)	Def Rebounds	Turnovers	Fouls
Negative Affect R.					
High	45.2 (6.9)	66.3 (10.9)	4.5 (1.6)†	2.7 (0.7)	4.8 (1.7)
Low	42.4 (11.5)	67.3 (15.3)	3.8 (1.5)†	2.9 (0.9)	4.5 (1.6)
Positive Affect R.					
High	47.1 (6.5)*	67.6 (9.8)	4.4 (1.3)	3.0 (0.7)†	4.8 (1.7)
Low	41.1 (10.7)*	66.2 (15.5)	4.0 (1.7)	2.6 (0.9)†	4.6 (1.6)
Overall	43.8 (9.5)	66.8 (13.2)	4.1 (1.6)	2.8 (0.8)	4.7 (1.6)

Note. † $p < .10$, * $p < .05$.

Within the framework of this study, we asked the coaching staff of the participating teams to define critical situations by the two dimensions *score* and *time*. Eleven of the 19 participating coaches of the first German basketball league stated a score difference of nine points as critical. Eight coaches named a time period of two or three minutes as critical, six coaches agreed with Bar-Eli and Tenenbaum's (1988) five-minute period. On average, a score difference of $M = 8.7$ ($SD = 3.1$) points and a time period of $M = 3.4$ ($SD = 1.4$) minutes to the end of the game were given as critical.

Table 3.3 Correlations between positive and negative affect regulation abilities of professional basketball players and performance measures of the entire season 2004/05 ($N = 56$)

	2	3	4	5	6	7
1 Negative Affect Regulation	.54**	.10	.09	.24†	-.08	.20
2 Positive Affect Regulation		.41*	.07	.31*	.27*	.19
3 Field Goals (%)			.28*	.59**	.53**	.27*
4 Free Throws (%)				-.02	.21	-.03
5 Defensive Rebounds					.27*	.39**
6 Turnovers						.22
7 Fouls						

Note. † $p < .10$, * $p < .05$, ** $p < .01$.

Critical Situations and Basketball Performance

Season Performance. Performance data from 218 league games were analyzed. Out of these, 117 games were close games, 101 were decided early and did not

end with critical situations. In Table 3.4, performance data are given for each of the four situations. Performance data is limited to variables which earlier research suggested to be very predictive for the outcome of a basketball game (Sanchez, 2006; Hofer & Hoink, 2003). A significant difference between players' performance in early decided games vs. close games was found for all variables in a MANOVA analysis, $F = 3.21$, $\eta^2 = .27$, $p < .05$. On a single level, turnovers were significant, $F = 8.79$, $\eta^2 = .16$, $p < .01$. For this comparison, only 50 players produced statistics for all the categories (see Table 3.4).

Table 3.4 Means and standard deviations ($\pm SD$) for games decided early vs. close games ($N = 50$) and non-critical vs. critical situations within close games ($N = 43$)

	Decided Early	Close Games			Sign.
		Total	Non-critical	Critical	
Field Goals (%)	44.2 (8.1)	45.9 (8.9)	46.5 (9.0)	45.6 (15.7)	ns
Free Throws (%)	68.9 (10.2)	69.0 (13.6)	68.8 (11.8)	66.5 (16.7)	ns
Defensive Rebounds	4.1 (1.6)	4.1 (1.6)	4.3 (1.5)	4.2 (2.1)	ns
Turnovers	3.0 (0.7)	2.7 (1.0)	2.7 (1.0)	2.6 (1.4)	**/-
Personal Fouls	4.6 (1.4)	4.5 (1.4)	3.9 (1.2)	6.5 (2.8)	-/**

Note. Firstly, *sign* indicates significance for the T-test between games decided early vs. close games, and, secondly, T-test between non-critical and critical situations within close games. ** $p < .01$.

Game Performance. In the 117 games ending with critical situations, 43 players had countable performance time within the last 5 minutes of a critical game. The MANOVA displayed a significant change in performance data for all variables, $F =$

11.90, $\eta^2 = .62$, $p < .001$. Players especially increased the number of personal fouls they committed in critical situations at high level, $F = 41.23$, $\eta^2 = .50$, $p < .001$. This is largely dependent on tactical aspects. Means and standard deviations are given in Table 3.4.

Affect Regulation and Basketball Performance

Negative Affect Regulation. Official season statistics were taken from the German first basketball league. Data for athletes' performance in critical situations were analyzed by a scouting company. Overall season statistics as well as statistics classified by the athletes' ability to regulate affect (action orientation – implicit processing vs. state orientation – explicit processing) can be found in Table 3.2. No differences were found between athletes with high vs. low ability to regulate negative affect (AOF) in the MANOVA, $F = 1.01$, $\eta^2 = .09$, $p = ns$. However, a non-significant difference was present between high, $M = 4.5$, $SD = 1.6$, and low affect regulators, $M = 3.8$, $SD = 1.5$, in the variable defensive rebounds, $F = 2.85$, $\eta^2 = .05$, $p < .10$.

Positive Affect Regulation. Although, the MANOVA did not show differences over all performance variables, $F = 1.33$, $\eta^2 = .12$, $p = ns$, there are two variables illustrating differences at single level. Athletes who are highly able to regulate positive affect (AOD), $M = 47.1\%$, $SD = 6.5\%$, display better field-goal percentages throughout the whole season, $F = 6.18$, $\eta^2 = .10$, $p < .05$, compared to players with low ability to regulate positive affect, $M = 41.1\%$, $SD = 10.7\%$. Furthermore, high affect regulators (AOD) commit more turnovers throughout the season, $M = 3.0$, $SD = 0.7$, than low affect regulators, $M = 2.6$, $SD = 0.9$. However, this difference is not statistically significant, $F = 3.32$, $\eta^2 = .06$, $p < .10$.

Table 3.5 Means (\pm SD) for basketball performance over the season in games decided early vs. close games ($N = 50$)

	Field Goal	Free Throw	Def. Rebound	Turnovers	Pers. Fouls
DECIDED EARLY					
Negative Affect R.					
High	45.3 (7.6)	65.8 (11.1)**	4.1 (1.7) **	3.0 (0.7)	4.5 (1.5)
Low	43.3 (8.5)	71.8 (8.5)**	4.1 (1.5) **	3.1 (0.8)	4.6 (1.3)
CLOSE GAMES					
Negative Affect R.					
High	45.1 (8.9)	72.0 (13.9)**	4.6 (1.6) **	2.5 (1.1)	4.2 (1.2)
Low	46.6 (9.0)	66.3 (12.9)**	3.7 (1.5) **	2.9 (1.0)	4.7 (1.5)
DECIDED EARLY					
Positive Affect R.					
High	46.9 (7.5)	67.6 (11.4)	4.1 (1.3)	3.1 (0.7)	4.7 (1.7)
Low	42.0 (8.0)	70.1 (9.1)	4.1 (1.8)	2.9 (0.7)	4.4 (1.1)
CLOSE GAMES					
Positive Affect R.					
High	48.9 (6.4)	71.0 (13.7)	4.5 (1.7)	2.9 (0.9)	4.4 (1.6)
Low	43.3 (10.0)	67.3 (13.5)	3.8 (1.4)	2.5 (1.1)	4.5 (1.2)

Note. ** $p < .01$.

Affect Regulation and Basketball Performance in Critical Situations

Negative Affect Regulation. The MANOVA showed that players highly able to regulate negative affect significantly improved their performance in close games in comparison to games decided early, $F = 3.62$, $\eta^2 = .29$, $p < .01$. They significantly improved their free throw performance, $F = 7.10$, $\eta^2 = .13$, $p < .01$, as well as the number of defensive rebounds they caught, $F = 8.75$, $\eta^2 = .15$, $p < .01$. After correcting alpha levels using Bonferroni-Holm's correction, results remained significant, $p < .01$. Descriptive statistics for the interaction results can be found in Table 3.5, inferential statistics for free throw performance and defensive rebounds in Tables 3.6 and 3.7.

When different affect regulators were compared in critical vs. non-critical situations within close games no differences could be shown, $F = 0.51$, $\eta^2 = .06$, $p = ns$

Table 3.6 Impact of ability to regulate negative affect on free throw performance in basketball in games decided early vs. close games ($N = 50$)

Source	df	F	η^2	p
Between subjects				
Negative Affect Regulation (NAR)	1	0.01	.00	.94
NAR within-group error	48	(155.88)		
Within subjects				
Critical/ Close Games (C/CG)	1	0.02	.00	.89
C/CG \times NAR	1	7.10**	.13	.01
C/CG within-group error	48	(119.87)		

Note. Values enclosed in parentheses represent mean square errors. ** $p < .01$.

Table 3.7 Impact of ability to regulate negative affect on defensive rebound performance in basketball in games decided early vs. close games ($N = 50$)

Source	df	F	η^2	p
Between subjects				
Negative Affect Regulation (NAR)	1	1.54	.03	.22
NAR within-group error	48	(4.23)		
Within subjects				
Critical/ Close Games (C/CG)	1	0.16	.00	.69
C/CG \times NAR	1	8.75**	.15	.005
C/CG within-group error	48	(0.62)		

Note. Values in parentheses represent mean square errors. ** $p < .01$.

Positive Affect Regulation. No overall effect was found for the comparison between high and low decision-related affect regulators in the MANOVA, $F = 1.27$, $\eta^2 = .13$, $p = ns$. As Table 3.5 illustrates, high affect regulators did increase the number of defensive rebounds in close games in comparison to games decided early while low affect regulators' performance suffered under stress, $F = 3.83$, $\eta^2 = .07$, $p < .10$. However, after Bonferroni-Holm's correction of alpha levels, this result is not significant.

Again, for the comparison between critical and non-critical situations of close games, no differences were found, $F = 1.27$, $\eta^2 = .13$, $p = ns$.

Discussion

Implicit Processing in Critical Situations. Comparable to study one, measures of the ability to regulate positive and negative affect do not predict performance outcomes in objectively critical situations as defined according to Bar-Eli's definition (Bar-Eli & Tractinsky, 2000). Neither positive nor negative affect regulation ability predict basketball players' performance within the final five minutes of a close game compared to their performance within the 35 minutes before. However, when players' performance is compared between close matches (ending in critical situations) and regular matches are decided early on in the game, affect regulation ability is a predictor of performance outcome. Yet in contrast to the tennis sample negative affect regulation seems to be an important ability for better free throw and defensive rebound performance. Implicitly processing athletes scored up to six percent more free throws in close games. Explicitly processing players showed performance impairments to about the same extent. Furthermore, high affect regulators (implicitly processing) caught one more rebound compared to low affect regulators (explicitly processing). This clearly has practical implications. If a team of five action-oriented players (implicitly processing) were to compete with a team of five state-oriented players (explicitly processing) these findings would lead to a difference of up to five defensive rebounds. Consequently, out of five defensive rebounds, at least two own baskets could be scored which means four additional points within a game. In addition, an increase of the free throw percentage by six could lead to one additional point scored when about 16 free throws are taken within a match.

In the game of tennis, state-oriented athletes (explicit processing) with a primary focus on the intention memory (IM) displayed better competitive performance in tie breaks. In basketball action-oriented individuals (implicit processing) clearly have the advantage. Over the course of the entire season, implicitly processing athletes

shoot six percent more field goals ($M = 47.1\%$) compared to explicitly processing players ($M = 41.1\%$). Especially in stressful situations like close games implicitly processing athletes performed better. In tennis the axis of goal setting (IM) and behavior implementation (IBC) seems to be important for predicting performance under stress. In basketball, however, it is the ability to regulate negative affect (implicit processing). Athletes who relied on experiences stored in the extension memory (EM) score more free throws and caught more defensive rebounds. One possible explanation is that high negative affect regulating athletes avoid input (OR) irrelevant for the performance at hand (free throws, defensive rebounds). This way they may predominantly act on the knowledge in their extension memory. Moreover, even if they perceived the intensity of the situation as stressful putting it into perspective with former experiences may help avoid performance impairments.

Specificity of Affect Regulation in Sports. Attention needs to be focused on basketball players' increased mean scores in the ability to regulate positive as well as negative affect when compared to the tennis sample or the norm sample. Differences between basketball and tennis players are significant concerning the regulation of positive affect ($p < .00$) and marginally significant for regulation of negative affect ($p < .10$). Yet when both tennis and basketball professionals are compared to a norm sample professional athletes display elevated levels of positive affect regulation. This might be attributed to a unique cortical organization found in highly skilled athletes (Carlstedt, 2004b).

Furthermore, the finding that players at the center position show a higher ability to regulate positive affect than guards is in line with earlier research with professional basketball players (Beckmann & Strang, 1991). From a theoretical perspective, it could be argued that playing basketball professionally is much more demanding on the ability to make connections between intentions (IM) and behavior (IBC). Additionally, routines from the IBC seem to be more important for centers who need to focus much more on

scoring points (automatization, IBC) than on organizing the structure of the game and being the coach's extension on the court (planning, IM). Overall, in basketball implicitly processing athletes highly able to regulate positive as well as negative affect show clear advantage over explicitly processing basketball players. Results are in line with findings on performance advantages of action-oriented basketball players in a stressful basketball task (Heckhausen & Strang, 1988) and findings from more natural basketball environments reported by Beckmann and Kazén (1994).

STUDY 3: IMPLICIT VS. EXPLICIT MOTIVES AND AFFECT REGULATION IN UNCONSCIOUSLY VS. CONSCIOUSLY CRITICAL SITUATIONS IN RACQUET SPORTS

In study one, a low ability to regulate affect (explicit processing) failed to predict performance in subjectively critical situations (as given by the athlete). Accordingly, in study two, a high ability to regulate affect (implicit processing) was not associated with competitive performance in objectively critical situations (final 5 minutes within a close game) as defined by Bar-Eli (Bar-Eli & Tractinsky, 2000). Thus, in situations very narrowly defined as critical, affect regulation could not be shown to be of predictive value. However, in both studies affect regulation ends up being more meaningful in high competitive sports when the scope of operationalization is extended to include data of an entire season or for career statistics.

Yet, in tennis as well as basketball these critical situations are objectively defined as tie breaks or close games in general. The focus of the present work, however, is to discriminate performances produced in critical situations that the athlete is consciously aware of from performances in critical situations that he is not explicitly aware of. That is why in study three the attempt was made to define situations as conscious but also as unconscious to the athlete within one competitive game. To this end, both methods used in studies one and two are combined into a new research design. In order to avoid influences from sports specific demands, the research is conducted in three kinds of sports with structural similarities – tennis, table tennis, and badminton.

In addition to the measures of affect regulation abilities, direct and indirect measures of motives were used. Since in study one and two volitional abilities (affect regulation) did not seem to predict performance measures in critical situations properly the motivational (implicit vs. explicit) perspective was added to the research design (McClelland, et al., 1989). Consequently, it is hypothesized that in consciously critical

situations explicitly processing athletes (low affect regulation & high explicit achievement or power motive) experience performance advantages. In contrast, when racquet players are not consciously aware of the criticality of a situation it is assumed that implicitly processing athletes (high affect regulation & high implicit achievement or power motive) perform better (cf. Baumann & Kuhl, 2002).

Method

Participants. Eighty-six male professional tennis ($N = 30$), table tennis ($N = 34$), and badminton players ($N = 22$) participated in the study. Players were recruited from clubs of the three respective German major leagues (*Bundesliga*, Division North). All of them were active players within their major leagues. On average, they were $M = 28.0$ ($SD = 6.5$) years old. The best national ranking was at $Mdn = 40$. Players were from thirteen different nations (Argentina, Brazil, Chile, China, France, Germany, Great Britain, Italy, Moldova, Netherlands, Romania, Sweden, and Spain).

Procedure. The study was carried out in the major league seasons 2009/2010, and 2010/2011. Prior to the start of the season in 2009, club officials or coaches were contacted. They, in turn, informed their players about the study. Before working on the psychological questionnaires, athletes signed an informed consent to participate. Players then received either a paper-and-pencil version of the tests via a club official or the coach, or directly via e-mail from the researchers. Optionally, players were able to fill out the questionnaire online. Either way the questionnaires were given in a fixed sequence. Athletes were always asked to fill out the indirect measure of implicit motives (*Operant Multi Motive Test*) first, followed by the measure of unconscious and conscious affect regulation (*Action Control Scale 90*), via the measure of conscious self-regulation (*Volitional Components Questionnaire*), to the most direct measure of ex-

plicit motives (*Personality Research Form*). After players had completed the questionnaire, one competitive match per athlete was recorded and documented by the researchers at an away game in Berlin. Coaches or club officials were reminded of the research project one week ahead. On match day, one hour prior to the start of the league games, team captains or coaches of both teams were welcomed by the research team and asked to inform their athletes that they need to talk to the researchers immediately after they had completed their individual league game. The match was recorded with a video camera placed at a height of at least three meters behind one end of the court or table. The researcher documented all scores and prominent events or incidents of the match on a paper form. Immediately after the competition (5-10 min), an interview was conducted with the player about subjective critical situations of the match, separately with either participant. They were confronted with the continuous score of their match and asked for subjectively (conscious) critical situations they had experienced. According to the players' response, the respective scores were marked subjectively critical. Furthermore, athletes were asked to score how dominantly they played against their opponent as well as how dominantly their opponents played. Finally, players were thanked for participation in the study and were debriefed about the real intention of the study.

Within-Subjects Variables

Consciously Critical Situations (Subjective). In an interview after the match, athletes were asked for critical situations they had experienced during the competition. The interview lasted about 10-15 minutes. First, critical situations were defined as subjectively very important and mentally stressing situations that influenced the progression of the match noticeably. To their mind, the situation was supposed to have an impact on winning or losing a set or the whole match. Players were asked to name all the

prominent situations they still remembered and determine a starting and end point for each critical situation with the help of the game score record. The definition of consciousness is in accordance with Bargh (1994) or Dijksterhuis and Aarts (2010). If players could not recall the single scores correctly they would use the researcher's documentation of the score as assistance. Consequently, all rallies were either coded non-critical or subjectively critical. Since players are consciously aware of these subjective critical situations it is assumed that direct measures of motivation (Personality Research Form) and volition (Volitional Components Questionnaire) ought to be associated with performance within these situations. For inferential analyses of critical situations, 52 players experienced both subjectively as well as objectively critical situations.

Besides critical situations on game level, tie breaks played over the course of the past four years were taken as another operationalization of repeated critical situations over a longer period of time. However, tie breaks have both conscious as well as unconscious parts. For this reason, we did not expect only direct measures to be predictors of tie-break performances.

Objectively Critical Situations. The operationalization of objectively critical situations is derived from research by Krohne and Hindel (1988) on critical situations in table tennis (p. 228). According to experts' ratings, Hindel (1989) defined six different critical situations in table tennis (p. 19). Critical situations occur after (1) an unfortunately lost point, (2) an unforced lost ball, (3) a series of faults, (4) a tie break, (5) hard-contested but lost rallies, and (6) personal unhappiness. These objectively critical situations were taken from the videotaped major-league matches and analyzed by trained experts. All rallies immediately after these six different situations are labeled objectively critical. All other situations are objectively non-critical. For all objectively critical situations, inter-rater agreement is at *Cohen's* $\kappa = .81$, and intra-rater correlation is at *Cohen's* $\kappa = .87$.

In the present study, unfortunately lost points were counted within each match. In all three sports, points are lost immediately after the opponent hits a lucky dead net cord, or the observed player hits the net cord but the ball falls down on his own side. Furthermore, in table tennis edge balls, and in tennis and badminton balls that bounce right on or off line to the opponent's advantage are considered unfortunately lost points. All service faults and double faults at service in tennis were labeled unforced lost balls since in all three kinds of sports these are situations that need to be avoided at all costs. According to Hindel (1989), a series of faults is identified as four points lost in a row. Within the present study, the rally immediately following four points lost in a row was labeled a critical point in all three kinds of sports. Overtime situations within a set were defined as tie-break situations in all three sports. In table tennis, tie breaks started at a set score of 10-10, in badminton at a set score of 20-20, and in tennis, at a set score of 5-5. All points after the respective score were defined as critical situations. Furthermore, hard-contested but lost rallies were identified in relation to the average length of rallies within the match. All rallies more than two standard deviations ($2 SD$) above the mean rally length of the individual match are counted as hard-contested but lost rallies when the rally is lost by the observed player. Finally, all personal expressions of unhappiness are defined as critical situations. Verbally or bodily expressed negative emotions like anger, fear, sadness, and despair are defined as critical. Among these expressions are swearing, gesticulating, and aggressive movements. Trained psychologists coded these expressions of negative emotions with an inter-rater reliability of *Cohen's* $\kappa = .78$ and an intra-rater reliability of *Cohen's* $\kappa = .85$.

Certainly, subjective as well as objective criticality could be ascribed to the same situation. Whenever an objectively critical situation is also labeled subjectively critical by the individual player it is only defined as a subjectively critical situation since the athlete is consciously aware of the criticality. Thus, all situations named subjectively critical by the player are excluded from objectively critical situations. Conse-

quently, objectively critical situations that are not subjectively critical are assumed to be unconscious to the athlete. In Figure 4.1, an example is illustrated how a game is divided into the three kinds of critical situations: non-critical (black), unconsciously critical (white), and consciously critical situations (gray).

All Situations within a Match				
Non-Critical		Consciously, Subjectively Critical		Non-Critical
	Unconscious	Objectively Critical		

Figure 4.1 Classification of critical situations within a match. In the case of overlapping objectively and subjectively critical situations, rallies are ascribed to conscious, subjectively critical situations (gray). The remaining objectively critical situations the athlete is not conscious of (white). Non-critical situations (black) only occur when situations are neither subjectively nor objectively critical.

Between-Subjects Variables

Implicit Motives. In order to assess athletes' implicit motives of achievement (*n* achievement), affiliation (*n* affiliation), and power (*n* power), the Operant Motive Test (OMT) was administered (J. Kuhl & Scheffer, 1999). In contrast to traditional measures of implicit motives, measures of classical test theory can be applied to the OMT. Both internal consistency ($\alpha = .70$) and retest stability ($\alpha = .70$) for the OMT are satisfying (Scheffer, et al., 2003). The OMT consists of fifteen ambiguous pictures (five per motive) for which athletes were asked to develop a story and respond with spontaneous associations to the four questions given for each picture (for an example, see Figure 4.2). These four questions are (1) *What is important for the person in this situation and what is the person doing?*, (2) *How does the person feel?*, (3) *Why does the person feel this way?*, and (4) *How does the story end?*.

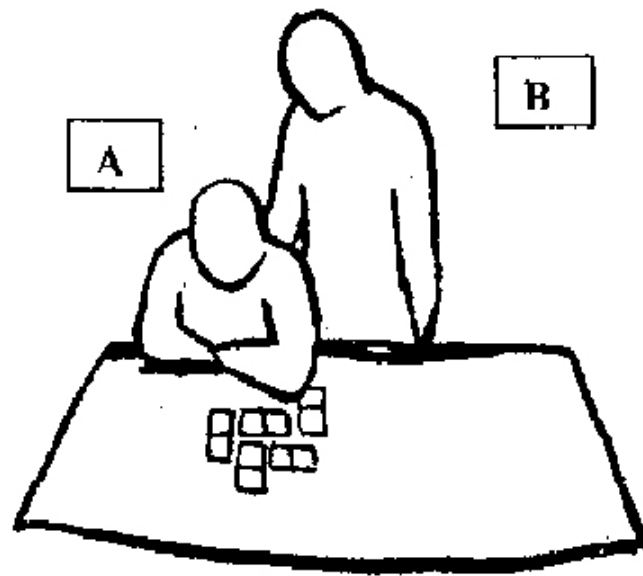


Figure 4.2 Example picture for the Operant Multi-Motive Test (OMT). Participants are asked to choose one person in the picture, to develop a story, and to respond to four questions about the persons in the picture and the story the participant developed.

The achievement motive (*n* achievement) is coded when the story is about an individual who deals with an internal or external standard of excellence (McClelland, et al., 1953). According to Winter (1994), an achievement motive is present when a behavior or goal is positively evaluated, or a (unique) success or failure are reported as a result of a competition or the person dealing with the standard of excellence. A picture will be assigned to the affiliation motive (*n* affiliation) when a situation is described in which a person wants to establish, maintain, or restore close, private, reliable, and reciprocal relationships with others (McClelland, 1985b; D. G. Winter, 1996). An affiliation motive can be expressed through positive or friendly feelings towards individuals, groups, or organizations, through negative affect upon the imminent end of a relationship, through social activities, or through caring (D. G. Winter, 1994). Finally, a power motive (*n* power) is present when a situation is displayed in which a person, group, or nation exhibit impact, control, or persuasiveness on others (McClelland, 1985b; D. G.

Winter, 1973). This is expressed in actions that imply having impact on others or their feelings, to persuade, manipulate, control or convince others but also to help, educate, and support others, or even impress others or gain reputation and status (D. G. Winter, 1994). Medium associations with the Thematic Apperception Test (TAT) are an indicator for convergent validity with existing measures of implicit motives (Murray, 1943). The achievement motive correlates at .64, the affiliation motive at .68, and the power motive at .57 with the respective measure of the TAT (J. Kuhl & Scheffer, 1999).

Explicit Motives. The explicit counterparts of the three basic motives are assessed by means of the Personality Research Form (PRF), which was introduced by Jackson (1967, 1999). The questionnaire measures fifteen aspects of personality and is based on Murray's (1938) theory of personality. Each scale consists of sixteen items, all statements about one's personality. Each item is answered dichotomously with *Right* or *Wrong*. For the present study, three subscales were administered: *achievement*, *affiliation*, and *dominance*. Internal consistencies reported for the three scales achievement (*Cronbach's* $\alpha = .77$), affiliation (*Cronbach's* $\alpha = .81$), and dominance (*Cronbach's* $\alpha = .86$) are good. Test-retest reliabilities at .80 for achievement, .79 for affiliation, and .88 for dominance are acceptable (D. N. Jackson, 1967). The achievement scale measures to what degree a person is willing to work towards distant goals, aspires to accomplish difficult tasks, and responds positively to competition (D. N. Jackson, 1999, p. 5). An example item is *I often set goals that are very difficult to reach*. A person high in the affiliation scale describes oneself as enjoying being with others and friends, and making efforts to establish and maintain friendships. An affiliation motive item is *I choose hobbies that I can share with other people*. Furthermore, the dominance scale is concerned with statements on how much a person strives to have influence on or control over others, and has positive associations with being a leader (D. N. Jackson, 1999). *I try to control others rather than permit them to control*

me is an item of the dominance scale. For all of the three example items, responses of *Right* are coded 1, and responses of *Wrong* are coded 0. Thus, the higher the score within the scale the higher an athlete's self-ascribed motive is. Internal consistencies in the third study were .70 for the achievement scale and .74 for the dominance scale.

Ability to Regulate Positive and Negative Affect. Assessment of racquet sportsmen's ability to regulate affect was in accordance with the procedure in study one and two. The English or the German version of the ACS-90 was applied. The ability to regulate positive affect was measured by the subscale decision-related action-orientation (AOD). The ability to regulate negative affect was measured by the subscale failure-related action orientation (AOF). Higher scores in both subscales represent a higher ability to regulate affect (implicit processing). Internal consistencies for the ACS subscales in study three were .74 (positive affect) and .70 (negative affect).

Self-Regulation Ability. The Volitional Component Questionnaire (VCQ; J. Kuhl & Fuhrmann, 1998) was administered to the athletes in order to assess their ability for explicit self-regulation under stress. Two scales of the questionnaire were administered: *volitional development* as well as *self-access*. Each scale consists of 12 self-statements. Participants have to decide how much a statement applies to themselves (1...not at all, 4...completely). The volitional development scale includes statements on how much an athlete is able to consciously initiate actions, is able to concentrate on them, and is able to direct his behavior toward a set goal. Thus, this scale contrasts volitional inhibition against volitional enactment. The self-access scale measures to what extent a person is able to integrate the inconsistencies of failed actions into the self, and is able to direct his attention toward a present action or goal. Internal consistencies for both scales are acceptable. Kuhl and Fuhrmann (1998) report *Cronbach's* $\alpha = .90$ for volitional development and *Cronbach's* $\alpha = .80$ for self-access. An example item for volitional development is *When I want to concentrate on something my*

thoughts often wander. The self-access scale is, by example, measured with items like *When something bad happens, it usually takes me a long time until I can concentrate on something else again.* As can be seen, items rather measure an inhibited ability. Thus, in the following *volitional inhibition* and *self-inhibition* will be referred to as sub-scales of self-regulation. In this study, *Cronbach's* α is .86 for volitional and .78 for self-inhibition respectively.

Career Performance

For sixty-eight participants complete career performance data were available. These data included practice hours and performance data for the past four years within the German major leagues.

Practice Hours. All athletes gave self-statements about the average amount of weekly practice hours they execute at present. In addition, players were asked about their career high in the amount of practice hours per week. That means how many hours they practiced at the time they worked hardest for their sport. Additionally, an index was calculated by subtracting the present amount of weekly practice hours from their career high (Δ High – Present). Participants high in the delta (Δ) exhibit a great difference between their maximum amount of practice hours and their present amount of practice hours.

Competitive Performance within the Past Four Years. Official online statistics for the past four years from all three major leagues (tennis, table tennis, badminton) were analyzed concerning the relative amount of matches and tie breaks won. That means the amount of all matches/ tie breaks won was divided by the amount of all matches/ tie breaks played and multiplied by a hundred. When the percentage of matches won was high the player had won most of the games within the past four years. Respectively, when an athlete had been more successful in winning tie-break

situations within the past four years he showed a higher percentage of tie breaks won. In table tennis, and badminton, all sets that pass a score of 10-10, or 20-20 are called tie breaks, respectively. In tennis, tie-break sets are sets that go beyond a score of 6-6. Comparing the percentage of matches won in all regular matches to the percentage of tie breaks won could also be an indicator for how well an athlete performs under pressure/ stress over a longer period of time (four years). Therefore, again, an index was calculated by subtracting the percentage of matches won from the percentage of tie breaks won (Δ Match – Tie Break). An athlete who exhibits a high delta (Δ) performs better in tie-break situations compared to his performance in regular matches.

Game Analyses

Videotaped games were available for fifty-two athletes. Thus, the total match time and self-statements about individual dominant play could be analyzed. Furthermore, means and standard deviations for rally lengths as well as the percentage of points won within the games recorded could be examined not only for the matches as a whole but also for consciously critical (subjective), unconsciously critical, and non-critical situations.

Match Time. The total duration of the matches is measured in minutes from the first hit till the final rally was decided. This was done in order to see whether motives or regulatory abilities have an influence on how much time an athlete takes for preparing and playing over the course of the match.

Dominant Play. Following the interview on subjectively (conscious) critical situations right after the recorded match, the players were asked to self-evaluate how dominantly they played against their opponents. That means how much pressure they put on their opponent within the game recorded. Players were asked to give a number between the two extremes of zero and one hundred. Zero indicated that the player did not

play dominantly at all, one hundred indicated that the player played as dominantly as he can imagine himself to play. In order to clarify the concept of dominant play, it was explained that dominant play not only means hitting the ball hard but also putting pressure on the opponent by means of playing very precise, slicing the ball, playing extreme angles, changing the rhythm, as well as using the space of the court by playing long and short balls (Schönborn, 1990).

Rally Length. An indicator of repeated effort to control or change the rhythm of the game is rally length. Low mean rally length can be a sign for impatience or a player's will to force the decision within a rally, or an expression of self-determined behavior. Furthermore, a low standard deviation in rally length could be an indicator of a steady way of playing, a high standard deviation in rally length might indicate attempts to put pressure on the opponent by varying the way of playing. To this end, it was counted how often the ball was hit for every rally within the games recorded, so means and standard deviations of rally length were at hand for consciously, and unconsciously critical as well as non-critical situations.

Points Won. As an index of overall performance efficiency, the percentage of points won within the videotaped match is calculated by dividing the number of points won by the number of all points played and multiplying it with one hundred. This could be important evidence on how much motivational or volitional factors influence overall efficiency in real competitive performance in racquet sports. This index is also at hand for all critical situations (conscious, unconscious, non-critical).

Design and Statistical Analyses. Since the present study utilizes the concept of implicit and explicit motivational processes for the sports domain, all inferential analyses are initiated by regression analyses. This is done in order to make useful predictions for sports practice. Within these regression models, the first question is whether implicit motives are able to account for additional variance compared to explicit motives. Secondly, it is analyzed whether the congruence of implicit and explicit motives

individually predicts career and match performance or whether a model including regulatory abilities accounts for additional variance. Inference from multiple regression models may be made on performances in the games recorded since questionnaires had been collected before games were recorded.

However, reports about practice behavior as well as analyses of competitive performance over the past four years had been proceeded before questionnaires were administered to participants. That is why analyses of variance (ANOVA) follow the regression models. Nevertheless, these analyses follow a quasi-experimental design meaning groups were formed on the basis of the situations that occurred and the individual differences that were present according to the questionnaires assessed. Three-way ANOVAs were calculated. The within-subject factor was formed by consciously vs. unconsciously critical situations. The between-subject factors are implicit (high vs. low) and explicit motives (high vs. low) for one analysis. For the second analysis the between-subject factors are motive congruence (high vs. low) and affect regulation ability (high vs. low) or self-regulation ability (high vs. low), respectively.

Dependent variables for regression analyses as well as analyses of variance are career performances as well as performances within the single games recorded. Career performances concern practice hours (career high, present) as well as competitive performances within the past four years (match percentage, tie break percentage). For the analyses of career performances, data were at hand only for sixty-eight participants. Additionally, single game performances were indicated by the duration of the match, the self-evaluation of dominant play, the mean and standard deviation of the rally length as well as the percentages of points won. The single games of fifty-two athletes could be recorded and analyzed within the study.

All data were processed using batch processing and statistical programs. Since differences between the three kinds of sports were present not only in dependent variables but also in personality variables z-transformations were carried out. This way,

differences could be attributed to individuals rather than systematic differences between the different kinds of sports.

Results

Descriptive Statistics

Implicit Motives. Within the Operant Multi Motive Test (OMT), the implicit power motive is more often coded for players of all three sports compared to the achievement motive (see Table 4.1). The two implicit motives are correlated significantly at medium level ($r = -.51, p < .01$). The assumption that implicit and explicit motives show zero correlations is met (see Table 4.2).

Explicit Motives. In contrast, the direct measure of the achievement motive is higher in comparison to the power motive for all three sports. Yet, these differences are more pronounced for tennis and table tennis athletes (see Table 4.1). Again, the explicit achievement motive is associated with the power motive at $r = .26$ level ($p < .05$). In a different way from implicit motives, this correlation is positive (see Table 4.2). In the present study, internal consistencies for the two scales are acceptable. For the achievement scale the *Cronbach's* α was .70, and for dominance .74.

Affect Regulation. Descriptive statistics for affect regulation abilities are presented in Table 4.1. There are no significant differences between athletes from the three different kinds of sports. However, badminton players show slightly lower levels of regulation abilities for both positive and negative affect. Interestingly, the measure of affect regulation ability comprises more shared variance with the measure of implicit motives than with the direct measure of explicit motives. Both the implicit power ($r = .22, p < .05$) and the implicit achievement motive ($r = -.18, p < .10$) are associated with the ability to regulate negative affect, even though at a low level only (see Table 4.2).

In the present study, internal consistencies were .70 for regulation of negative affect and .74 for regulation of positive affect.

Table 4.1 Means and standard deviations ($\pm SD$) for implicit and explicit motive measures as well as affect and self-regulation abilities of professional tennis, table tennis, and badminton players ($N = 86$)

Measures	Total ($N = 86$)	Tennis ($N = 30$)	Table Tennis ($N = 34$)	Badminton ($N = 22$)
IMPLICIT MOTIVES (OMT)				
1 Achievement	2.7 (± 1.1)	2.8 (± 1.1)	2.8 (± 0.9)	2.6 (± 1.4)
2 Power	9.8 (± 1.8)	9.4 (± 2.3)	10.1 (± 1.6)	9.9 (± 1.4)
EXPLICIT MOTIVES (PRF)				
3 Achievement	11.2 (± 2.8)	11.6 (± 2.3)	11.2 (± 2.6)	10.5 (± 3.6)
4 Power	9.7 (± 3.4)	9.6 (± 3.2)	9.4 (± 3.3)	10.3 (± 3.8)
AFFECT REGULATION (ACS)				
5 Negative Affect Regulation	5.9 (± 2.9)	6.2 (± 3.4)	6.2 (± 3.4)	5.5 (± 2.8)
6 Positive Affect Regulation	6.5 (± 3.0)	6.9 (± 3.4)	6.9 (± 2.8)	5.5 (± 2.6)
SELF-REGULATION (VCQ)				
7 Volitional Inhibition	2.0 (± 0.6)	2.0 (± 0.6)	2.0 (± 0.5)	2.2 (± 0.5)
8 Self-Inhibition *	2.3 (± 0.5)	2.5 (± 0.5)	2.1 (± 0.5)	2.3 (± 0.4)

Note. * $p < .05$

Table 4.2 Inter-correlation coefficients for z-transformed implicit (OMT) and explicit motive (PRF), affect regulation (ACS), and self-regulation measures (VCQ) for tennis, table tennis, and badminton players ($N = 86$)

Measures	2	3	4	5	6	7	8
IMPLICIT MOTIVES (OMT)							
1 Achievement	-.51**	.08	-.15	-.18†	-.11	-.02	-.17
2 Power		.08	.17	.22*	.05	-.01	.15
EXPLICIT MOTIVES (PRF)							
3 Achievement			.26*	.15	.13	-.23*	-.12
4 Power				.09	.06	-.10	.02
AFFECT REGULATION (ACS)							
5 Negative Affect Regulation					.49**	-.24*	.08
6 Positive Affect Regulation						-.39**	.08
SELF-REGULATION (VCQ)							
7 Volitional Inhibition							.28**
8 Self-Inhibition							

Note. † $p < .10$, * $p < .05$, ** $p < .01$.

Self-Regulation. Values of volitional enactment are equal for all three sports. Self-enactment abilities in threatening situations are significantly lower for tennis players compared to table tennis and badminton players (see Table 4.1). Still, both abilities for conscious self-regulation (volitional and self-enactment) are associated at a low level ($r = .28$, $p < .01$). Furthermore, the self-regulation component of volitional inhibition under stress is negatively associated with the explicit measure of the achievement motive. However, none of the two scales that measure conscious self-regulation are

correlated to implicit motives (see Table 4.2). Within the present study the volitional inhibition under stress component shows an internal consistency of $\alpha = .86$. The self-inhibition under stress component is reliable at $\alpha = .78$.

Career Performance. Data on athletes' performance over the past four years within the first and second German major league (tennis, table tennis, and badminton *Bundesliga*) are available only for 68 participants. In Table 4.3, career statistics are presented for the present amount of weekly practice hours (*Present*), the career high in weekly practice hours (*Career High*) as well as the difference between career high and present weekly practice hours (Δ *Career High – Present*). Furthermore, the percentages of matches (*Matches*), and tie-break sets won (*Tie Breaks*) within major league competitions of the past four years are presented. Additionally, the increase in performance from regular matches to tie-break sets is given (Δ *Tie Breaks – Matches*). Concerning the practice variables, significant changes are present in tennis players compared to table tennis and badminton players. Their maximum practice load exceeds the maximum level of the other two sports by an average of about eight hours per week (see Table 4.3). These differences are less pronounced for present practice hours.

Correlations shown in Table 4.4 are associations between z-standardized scores of personality variables (implicit, explicit motives, affect regulation, self-regulation) and career data (practice hours, competitive performance). The implicit power motive is positively associated with athletes' career high of practice loads as well as the difference between career high and present practice hours. Meaning that athletes high in the implicit power motive are associated with high practice loads at career high and low practice loads at present and vice versa ($r = .32, p < .01$). While the implicit power motive correlates with the practice sector, the explicit achievement and power motive are associated with the competition sector.

Table 4.3 Means and standard deviations ($\pm SD$) for career data regarding amount of practice hours and competition outcomes for tennis, table tennis, and badminton players ($N = 68$)

Measures	Total	Tennis	Table Tennis	Badminton
PRACTICE HOURS				
Career High **	20.8 (± 8.5)	26.0 (± 8.4)	18.2 (± 7.8)	18.9 (± 7.0)
Present †	11.4 (± 8.1)	12.8 (± 10.2)	9.4 (± 6.8)	14.2 (± 6.6)
Δ Career High – Present **	9.3 (± 8.2)	13.2 (± 7.4)	8.9 (± 8.3)	4.6 (± 6.8)
COMPETITION (4 Years)				
Matches Won (%)	49.6 (± 17.7)	44.4 (± 21.7)	53.4 (± 10.3)	48.5 (± 23.3)
Tie Breaks Won (%)	49.8 (± 13.4)	47.0 (± 12.1)	51.4 (± 6.3)	50.1 (± 24.1)
Δ Tie Breaks – Matches	0.2 (± 15.8)	2.7 (± 19.8)	-2.1 (9.4)	1.6 (21.1)

Note. † $p < .10$, ** $p < .01$.

Both explicit motives correlate at low level with the performance shown in the past four years; not only regarding the match percentage but also the percentage of sets won in tie breaks (see Table 4.4). The ability to regulate positive and negative affect can be described as a conscious as well as a non-conscious process. None of the two affect regulation scales correlate with career data of the practice or competition sector. In contrast, the conscious ability for self-regulation is associated with the difference between the percentage of tie-break sets won minus the percentage of matches won within the past four years. That means that athletes who show high levels of volitional and self-inhibition in stressful situations perform better in tie breaks compared to regular matches and vice versa (see Table 4.4). It is pointed out that these are descriptive statistics that need not be interpreted causally.

Table 4.4 Inter-correlation coefficients for z-transformed motivational (OMT, PRF) and volitional personality measures (ACS, VCQ), and career data on practice loads and performance in competition for tennis, table tennis, and badminton players (N = 68)

Measures	Practice Hours			Competition (4 Years)		
	High	Present	Δh	Match	Tie	$\Delta T-M$
IMPLICIT MOTIVES (OMT)						
1 Achievement	-.03	.07	-.16	.09	-.06	-.12
2 Power	.20†	-.09	.32**	-.11	.22†	.24†
EXPLICIT MOTIVES (PRF)						
3 Achievement	.04	.04	.01	-.25*	-.31**	.02
4 Power	.17	-.01	.21†	-.21†	-.19	.06
AFFECT REGULATION (ACS)						
5 Negative Affect Regulation	.13	-.01	.16	-.05	.01	.06
6 Positive Affect Regulation	.14	.16	.01	.02	-.19	-.13
SELF-REGULATION (VCQ)						
7 Volitional Inhibition	-.20	-.08	-.13	-.14	.16	.29*
8 Self-Inhibition	-.08	-.09	.02	-.19	-.04	.23†

Note. *High*: career high in weekly practice hours; *Present*: present amount of weekly practice hours; Δh : career high minus present amount of practice hours; *Match*: percentage of matches won within the past four years; *Tie*: percentage of tie breaks won within the past four years; $\Delta T-M$: difference of percentage of tie breaks minus matches won. † $p < .10$, * $p < .05$, ** $p < .01$.

Game Analysis. League games from only 52 out of the 68 participants for whom career performance data are described above could be used for analysis since games with both consciously and unconsciously critical situations were available only for those

52. In Table 4.5, averages for the duration of the match (*Match Time*), and mean rally lengths (*Rally Length*) are given. Further, percentages of total points won (*Total*), when serving (*Service*), and returning (*Return*) as well as the self-evaluation of personal dominance (*Dominant Play*) are presented. General facts given in Table 4.5 represent well-known structural differences between the three sports. In tennis, significantly more points are played within a match, which leads to a longer match time compared to table tennis and badminton. Regarding the rally length, in badminton players need to hit the ball more often in order to score a point. Tennis and table tennis are much more alike in this regard. Furthermore, badminton players do not receive any advantage by serving. While tennis and table tennis players win up to 10% more points when they serve, badminton players' percentage of points won remains approximately stable. Reasons for this difference could be a lack of means to dominate the service game. In tennis, players are able to hit a ball very strongly; in table tennis players may slice the ball in different ways in order to put pressure on the returning player. Both options do not put much pressure on a badminton player. Additionally, in badminton, all the play happens within a court defining the limits within which the player moves and the ball lands. That means, in badminton a player is not able to put pressure on his opponent by sending him out of court limits by playing extreme angles or hard, long balls. This might be the reason why badminton players on average evaluate their game with smaller percentages of dominant play towards their opponent (see Table 4.5). In tennis and table tennis players perceive their game as equally dominant. Interestingly, the explicit achievement motive is negatively related to how much pressure a player puts on his opponent ($r = -.38, p < .01$). This correlation could be expected since players gave subjective statements about their dominance right after the recorded game. However, also the implicit power motive is negatively associated with dominant play, meaning that the higher the implicit power motive is the less dominant players perceive themselves, and

vice versa ($r = -.32$, $p < .05$). Even if the actual percentage of points won is residualized, on the whole, these associations remain intact.

Table 4.5 Means and standard deviations ($\pm SD$) for data from the game analysis regarding practice loads and competition outcomes for tennis, table tennis, and badminton players ($N = 52$)

Measures	Total	Tennis	Table Tennis	Badminton
GENERAL				
Match Time (min) **	49.3 (± 29.3)	86.4 (± 18.9)	29.8 (± 9.3)	36.9 (± 11.2)
Rally Length **	5.1 (± 1.4)	5.2 (± 1.1)	4.5 (± 0.7)	7.3 (± 1.6)
POINTS WON (%)				
Total	49.1 (± 6.7)	49.8 (± 7.6)	49.0 (± 6.3)	47.5 (± 6.5)
Service *	56.3 (± 8.8)	59.6 (± 9.9)	56.2 (± 7.9)	48.5 (± 3.7)
Return	42.1 (± 9.9)	40.1 (± 10.6)	41.9 (± 8.8)	47.6 (± 11.8)
DOMINANT PLAY				
Dominant Play *	63.0 (± 20.3)	66.3 (± 17.0)	65.4 (± 21.4)	45.0 (± 15.6)

Note. * $p < .05$, ** $p < .01$.

While the explicit measure of conscious self-regulation (VCQ) also shows no correlation to any of the game analysis variables presented in Table 4.6, the implicit scales of the OMT and the affect regulation measure (ACS) reveal several associations. High implicit achievement motives are positively related to overall playing time; thus these athletes play longer. Furthermore, athletes high in the ability to regulate positive and negative affect show a trend to play shorter matches and shorter rallies. In addition, both affect regulation abilities tend to be associated with the percentage of

points won when serving. This is also true for the achievement motive, which is positively related with points won at serve as well. Furthermore, the implicit power motive, by trend, is not only associated with the percentage of points won at return but also with the total percentage of points won. Again, these associations are only descriptive statistics, which need not be interpreted causally.

Table 4.6 Inter-correlation coefficients for motivational (OMT, PRF) and volitional personality measures (ACS, VCQ) and game analysis data for tennis, table tennis, and badminton players ($N = 52$)

	GENERAL MATCH		POINTS			DOMINANT
	Time	Rally	Total	Service	Return	Domin. Play
IMPLICIT MOTIVES (OMT)						
1 Achievement	.27†	.14	.21	.23†	.11	.16
2 Power	-.21	-.07	-.26†	-.06	-.30*	-.32*
EXPLICIT MOTIVES (PRF)						
3 Achievement	.09	.08	-.17	.01	-.27	-.38**
4 Power	.03	-.01	-.13	-.10	-.12	-.11
AFFECT REGULATION (ACS)						
5 Negative Affect Regulation	-.24†	-.34*	.07	.23†	-.07	-.09
6 Positive Affect Regulation	-.08	-.25†	.14	.27†	-.02	-.12
SELF-REGULATION (VCQ)						
7 Volitional Inhibition	-.01	.12	-.01	-.06	.02	.16
8 Self-Inhibition	.10	.09	.01	.08	-.06	.02

Note. † $p < .10$, * $p < .05$, ** $p < .01$.

Table 4.7 Means and standard deviations (\pm SD) for data from the game analysis regarding the number of critical points (%), points won (in %), means and standard deviation for rally length (# of hits) in different critical situations for tennis, table tennis, and badminton players ($N = 52$)

Measures	Total	Tennis	Table Tennis	Badminton
CRITICAL POINTS (%)				
Non-Critical	63.5 (\pm 9.9)	65.0 (\pm 7.6)	62.4 (\pm 10.5)	64.4 (\pm 13.0)
Consciously Critical	13.5 (\pm 14.8)	16.0 (\pm 19.3)	11.4 (\pm 10.5)	16.1 (\pm 18.2)
Unconsciously Critical	23.5 (\pm 10.9)	22.5 (\pm 10.4)	24.6 (\pm 12.0)	21.1 (\pm 6.6)
POINTS WON (%)				
Non-Critical	49.0 (\pm 6.6)	50.0 (\pm 5.5)	48.7 (\pm 7.0)	47.7 (\pm 7.8)
Consciously Critical	47.3 (\pm 33.8)	45.4 (\pm 34.8)	47.5 (\pm 33.3)	51.6 (\pm 38.1)
Unconsciously Critical	51.0 (\pm 12.7)	48.3 (\pm 9.8)	52.3 (\pm 13.7)	52.2 (\pm 15.6)
MEAN RALLY LENGTH				
Non-Critical **	5.1 (\pm 1.5)	5.1 (\pm 1.1)	4.5 (\pm 0.7)	7.5 (\pm 2.2)
Consciously Critical *	5.6 (\pm 2.4)	6.1 (\pm 1.6)	4.8 (\pm 2.0)	7.5 (\pm 2.4)
Unconsciously Critical **	4.9 (\pm 1.5)	5.0 (\pm 1.4)	4.3 (\pm 0.8)	7.1 (\pm 1.6)
SD OF RALLY LENGTH				
Non-Critical **	3.4 (\pm 1.5)	4.0 (\pm 1.0)	2.5 (\pm 0.7)	5.4 (\pm 2.1)
Consciously Critical **	3.8 (\pm 2.5)	4.6 (\pm 1.9)	2.6 (\pm 1.2)	6.3 (\pm 5.0)
Unconsciously Critical **	3.0 (\pm 1.4)	3.6 (\pm 1.2)	2.2 (\pm 0.9)	5.0 (\pm 1.6)

Note. * $p < .05$, ** $p < .01$.

Performance in Critical Situations. In Table 4.7, different performance measures are illustrated with regard to changes in performance in consciously and unconsciously

critical situations. Among these variables are the percentages of points won as well as the means and standard deviations of rally lengths. Further, it is shown how many points (in %) were identified as subjectively critical (conscious) by the participants or coded objectively critical (unconscious) by the raters. It becomes obvious that consciously critical situations form the least proportion of all points (14%) followed by unconsciously critical situations (23.5%). Of course, the vast amount of situations within a match is non-critical (63.5%).

No differences between the three kinds of sports are present concerning the outcome of athletes' performance within different critical situations (POINTS WON). However, differences that are present in non-critical situations remain significantly different among sports in both consciously and unconsciously critical situations. This is not only true for mean rally lengths but also for the respective standard deviations (see Table 4.7).

In Table 4.8, intercorrelations between z-transformed performance data in critical situations and personality variables are displayed. Evidently, measures of implicit motives and affect regulation are primarily associated with performance in non-critical or unconsciously critical situations while measures of explicit motives and self-regulation are mildly correlated with performance in consciously critical situations. In detail, the implicit achievement motive is positively associated with points won in unconsciously critical situations while the implicit power motive correlates negatively with this performance variable ($ps < .05$).

The ability to regulate negative affect is negatively associated with means and standard deviations of rally length in non-critical situations and mean rally length in unconsciously critical situations ($ps < .05$). That means that athletes high in the ability to regulate negative affect play shorter rallies with little variation within these situations, and vice versa. Similar but less pronounced are correlations for positive affect regulators (see Table 4.8). Interestingly, athletes high in the ability to regulate negative affect

Table 4.8 Inter-correlation coefficients for motivational (OMT, PRF) and volitional personality measures (ACS, VCQ) and percentage of points won (POINTS) as well as rally length (RALLY MEAN, SD) in non-critical (NON), consciously critical (CON), and unconsciously critical situations (UN) within the game analysis data for tennis, table tennis, and badminton players ($N = 52$)

BEHAVIOR & PERFORMANCE IN CRITICAL SITUATIONS									
POINTS	RALLY MEAN			RALLY SD					
Measures	NON	CON	UN	NON	CON	UN	NON	CON	UN
IMPLICIT MOTIVES									
1 Achievement	.03	-.02	.29*	.08	-.05	.11	.11	.05	.16
2 Power	-.10	-.03	-.29*	-.04	.14	-.06	.00	.06	-.03
EXPLICIT MOTIVES									
3 Achievement	-.19	-.32*	.06	.11	-.10	.19	.11	.13	.21
4 Power	.02	-.25†	-.21	.02	.04	-.02	.08	.16	-.06
AFFECT REGULATION									
5 Negative Affect	.17	.33*	-.11	-.30*	-.04	-.31*	-.28*	-.10	-.21
6 Positive Affect	.07	.13	.26†	-.25†	.16	-.23	-.22	.12	-.26†
SELF-REGULATION									
7 Volitional Inhibition	-.08	.20	-.19	.13	.00	.07	.17	-.03	.07
8 Self-Inhibition	-.02	.32*	.05	.04	.11	.10	.05	.21	.08

Note. † $p < .10$, * $p < .05$.

win more points in consciously critical situations ($p < .05$) while athletes high in the ability to regulate positive affect by trend are associated with a higher percentage of points won in unconsciously critical situations ($p < .10$).

Associations between clear direct measures and performance in consciously critical situations are present but rare. Both explicit motives (achievement, power) are negatively associated with points won only in consciously critical situations (see Table 4.8) meaning that the higher athletes' values of self-attributed motives are the less points they score in consciously critical situations and vice versa. At the same time, the self-inhibition scale of the VCQ is positively related to points won in these consciously critical situations ($p < .05$). However, none of these direct measures correlate with mean rally length or standard deviation in rally length. Again, it is pointed to the fact that all explanations within this paragraph are of descriptive value and should not be interpreted causally.

Principal Components Analysis

Preconditions. In order to avoid the problem of multicollinearity to be able to conducting multiple regression analyses and analyses of variance the number of predictor variables were reduced by means of a principal components analysis. The Bartlett test on sphericity is significant, $\chi^2(28) = 96.33$, $p < .001$, suggesting that correlations between the variables are sufficiently high in order to conduct a principal components analysis. Also, the Kaiser-Meyer-Olkin criterion (KMO; at least $> .50$) helps in deciding whether the sample size is adequate for applying this data reduction method. In this study, the criterion (KMO = .58) is at a mediocre level (Hutcheson & Sofroniou, 1999; Kaiser, 1970). Furthermore, average communalities for all constituent variables are .73 (all $> .65$). This indicates that conducting a principal components analysis is adequate even though the sample size is smaller than 100 participants (MacCallum,

Zhang, Preacher, & Rucker, 2002). Since questionnaires for 86 participants are available it is acceptable to use eight variables. Kass and Tinsley (1979) as well as Nunnally (1978) suggest at least ten participants per constituent variable for conducting a principal components analysis.

Extraction of Components. Components are rotated using oblique rotation since low correlations between the latent variables (components) are theoretically assumed. These associations are expected for the measures of affect and self-regulation but not between implicit and explicit motives. A fixed solution of four components was suggested according to the number of questionnaires used within the study. This way, it was possible to establish one component for the implicit motives, one for the explicit motives, one for affect regulation abilities, and the final one for self-regulation abilities (for component names see Table 4.10). These components were saved as a variable using the regression method and subsequently used to conduct inferential statistics.

The four-component solution explains 73% of the variance. All eigenvalues but one are above 1.00 (Kaiser, 1960). Only the fourth component holds an eigenvalue of .94 which is still above the acceptable level of .70 (Jolliffe, 1986). Additionally, the four-component solution is the most adequate model according to the scree plot. In Table 4.9, component loadings are presented for the pattern (regression coefficients) and structure matrix (correlation coefficients). All component loadings are above the .60 level, the minimum recommended value for a sample size of 80 participants (Stevens, 2002). The small differences between the pattern and structure matrix suggest little correlations between the individual components established. Finally, all component names are derived from the theoretical background of the questionnaires administered (see Table 4.10).

Table 4.9 Pattern and structure matrix for the four-component model of the principal components analysis using oblique rotation ($N = 86$)

PATTERN MATRIX				
	Component 1	Component 2	Component 3	Component 4
	PANAR	OMT-AP	PRF-AP	SIVI
ACS-PA (.89)		OMT-Ach (-.88)	PRF-Pow (.81)	VCQ-SI (.91)
ACS-NA (.77)		OMT-Pow (.84)	PRF-Ach (.78)	VCQ-VI (.62)
Eigenvalue	2.04	1.64	1.19	0.94
% of Variance	25.6	20.5	14.8	11.8
STRUCTURE MATRIX				
	Component 1	Component 2	Component 3	Component 4
ACS-PA (.87)		OMT-Ach (-.87)	PRF-Pow (.80)	VCQ-SI (.89)
ACS-NA (.79)		OMT-Pow (.85)	PRF-Ach (.79)	VCQ-VI (.67)

Note. ACS-PA: Action Control Scale – Positive Affect Regulation; ACS-NA: Action Control Scale – Negative Affect Regulation; OMT-Ach: Operant Multi Motive Test – Achievement Motive; OMT-Pow: Operant Multi Motive Test – Power Motive; PRF-Ach: Personality Research Form – Achievement Motive; PRF-Pow: Personality Research Form – Power Motive; VCQ-SI: Volitional Components Questionnaire – Self-Inhibition; VCQ-VI: Volitional Components Questionnaire – Volitional Inhibition.

Table 4.10 Component names and component correlation matrix of the four-component model ($N = 86$)

Component Names	2	3	4
1 Affect-Regulation under Stress (PANAR)	.12	.16	-.10
2 Use Internal vs. External Resources for Energizing (OMT-AP)		.11	.17
3 Use Internal et External Resources for Accomplishing Goals (PRF-AP)			-.12
4 Self-Regulation under Stress (SIVI)			

Implicit vs. Explicit Motivational Processes and Career Performance

All inferential statistics are introduced by multiple regression analyses, which are integrated to support understandings of practical implications of the findings. Causal interpretations are possible for the data of the games recorded since questionnaires had been administered before match performances were provided.

However, inferences on career performance need to be treated more carefully. Regression analyses are done in two steps with forced entries of the predictor variables. When the assumption that implicit motives better predict a certain outcome is tested the first step of the regression model is formed by the explicit motive component (PRF-AP) followed by the implicit motive component (OMT-AP) in the second step. For testing the predictive value of motive congruence the regression model is formed by the congruence value (Δ AP) as a first step and succeeded by affect (PANAR) and self-regulation (SIVI) abilities as a second step. Sample sizes of $N = 68$ for the career hypotheses and $N = 52$ for the analyses of game data are sufficiently high to achieve large effects for two to three predictor variables (Miles & Shevlin, 2001). Following regressions, analyses of variance (ANOVA) are conducted. Most of the analyses of variance administered follow a $2 \times 2 \times 2$ design with repeated measures on the third factor.

For this design, at least eight participants are needed per cell in order to document large effects (Bortz & Döring, 2002; Cohen, 1988). This criterion is met as well.

Table 4.11 Overview on multiple regression analyses conducted on the link between career performance and personality variables ($N = 68$)

	Predictors				
Criteria	Step 1	Step 2	R^2	ΔR^2	p
PRACTICE HOURS					
Career High	PRF-AP	OMT-AP	.03	.02	.24
	Δ AP	PANAR, SIVI	.02	.05	.19
Present	PRF-AP	OMT-AP	.00	.01	.68
	Δ AP	PANAR, SIVI	.01	.02	.54
Δ Career High – Present	PRF-AP	OMT-AP	.03	.08*	.02
	Δ AP	PANAR, SIVI	.00	.01	.83
COMPETITION (4 Years)					
Matches Won (%)	PRF-AP	OMT-AP	.09*	.01	.03
	Δ AP	PANAR, SIVI	.07*	.05	.04
Tie Breaks Won (%)	PRF-AP	OMT-AP	.09*	.04†	.01
	Δ AP	PANAR, SIVI	.17***	.01	.00
Δ Tie Breaks – Matches	PRF-AP	OMT-AP	.00	.05†	.19
	Δ AP	PANAR, SIVI	.00	.09*	.09

Note. † $p < .10$, * $p < .05$, *** $p < .001$.

Table 4.12 Multiple regression analyses on the link between the difference between career maximum and present amount of practice hours and implicit (OMT-AP) vs. explicit motives (PRF-AP) of achievement and power ($N=68$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	0.00	0.12	
Explicit Motives (PRF-AP)	0.17	0.12	.17
STEP 2			
Constant	-0.01	0.11	
Explicit Motives (PRF-AP)	0.16	0.12	.15
Implicit Motives (OMT-AP)	0.29	0.12	.29*

Note. $R^2 = .03$ for step 1 (*ns*), $\Delta R^2 = .08$ for step 2 ($p < .05$). * $p < .05$.

Practice Hours. It is hypothesized that implicit motives as well as the congruence of implicit and explicit motives should be better predictors of long-term athletic behavior like career highs in the amount of practice hours. In order to test these assumptions, multiple regression analyses were conducted. Apparently regression analyses on practice behavior do not display a clear benefit for the implicit motive component in predicting the amount of practice hours at career high or at present (Table 4.11). However, implicit motives are able to explain variance over and above the explicit component for the difference in the amount of practice hours between career high and present (Δ Career High – Present). Hence a huge difference between the practice load at career high and at present is preferably associated with a high implicit motive.

From Table 4.4 we can infer that this difference is derived from the positive association of the power motive ($r = .32$, $p < .01$) rather than the achievement motive ($r =$

-.16, $p = ns$). That means athletes high in the implicit power motive practice with higher work loads at their career maximum compared to their current amount of practice hours. The model is a significant predictor of the delta in practice hours (Δ Career High – Present) with a standardized $\beta = .29$ ($p < .05$) only if the implicit motive component is added to the explicit one (see Table 4.12).

Table 4.13 Impact of the explicit (PRF-AP) and implicit motive component (OMT-AP) on the amount of practice hours at career high vs. at present ($N = 68$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Explicit Motive Comp. (PRF-AP)	1	1.09	.02	.30
Implicit Motive Comp. (OMT-AP)	1	0.00	.00	.99
PRF-AP \times OMT-AP	1	7.18**	.10	.01
Within-group error	64	(1.35)		
Within subjects				
Career High – Present	1	0.00	.00	.96
High – Present \times PRF-AP	1	1.57	.02	.22
High – Present \times OMT-AP	1	2.53	.04	.12
H – P \times PRF-AP \times OMT-AP	1	0.02	.00	.89
Within-group error	64	(0.48)		

Note. Values enclosed in parentheses represent mean square errors. High – Present (H – P) denounce the difference between the amount of hours practiced at career high and at present. ** $p < .01$.

Table 4.14 Impact of the explicit motive component (PRF-AP) on the percentages of matches vs. tie breaks won within the past four years ($N = 68$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Explicit Motive Comp. (PRF-AP)	1	2.83†	.04	.10
Implicit Motive Comp. (OMT-AP)	1	1.09	.02	.30
PRF-AP \times OMT-AP	1	2.62	.04	.11
Within-group error	64	(1.35)		
Within subjects				
Tie Break – Match	1	0.01	.00	.91
Tie Break – Match \times PRF-AP	1	0.03	.00	.85
Tie Break – Match \times OMT-AP	1	3.00†	.05	.09
T – M \times PRF-AP \times OMT-AP	1	0.00	.00	.97
Within-group error	64	(0.52)		

Note. Values enclosed in parentheses represent mean square errors. Tie Break–Match (T–M) denotes the difference between regular match performance (in %) vs. performance in tie breaks (in %). † $p < .10$.

Within the analysis of variance the impact of the explicit and the implicit component on the changes in the amount of practice hours from career high to present is tested (see Table 4.13). Surprisingly, a between subjects interaction effect is found in favor of motive incongruence, $F(1,64) = 7.18$, $p < .01$. The amount of practice hours both at career highs as well as at present is higher for athletes with incongruent motives. Racquet players high in the explicit and low in the implicit motive as well as play-

ers low in the explicit and high in the implicit motive practiced more hours at career highs and at present. Furthermore, the data on mean practice hours suggest that players with a high implicit motive component practiced more hours at their career high but less hours at present. According to Table 4.4, this effect can be attributed to the implicit power motive. However, no significant results are found for only the explicit motive, $F(1,64) = 1.57$, $p = ns$ (MANOVA), or only the implicit motive, $F(1,64) = 2.53$, $p = ns$ (MANOVA).

Competitive Performance. From Table 4.11, it can be seen that the explicit motive component (*PRF-AP*) is a significant negative predictor of competitive performance for the past four years within the German major league (*Bundesliga*) with regard to both matches, $R^2 = .09$, $p < .05$, $\Delta R^2 = .01$, $p = ns$, as well as tie breaks won, $R^2 = .09$, $p < .05$, $\Delta R^2 = .04$, $p < .05$. For matches won, the standardized $\beta = -.30$ for the explicit motive component ($p < .05$) while the standardized $\beta = -.09$ for the implicit motive component ($p = ns$). For tie breaks, $\beta = -.31$ for the explicit motive component ($p < .01$) and $\beta = .20$ for the implicit motive component ($p < .10$). In Table 4.14, the between subject factor illustrates that differences between individuals regarding their explicit motives (high, low) are marginally significant in both situations matches as well as tie breaks, $F(1,64) = 2.83$, $p < .10$. That means that athletes low in the explicit motive component performed better in matches and tie breaks compared to athletes with a high explicit motive component. From Table 4.4, it becomes apparent that rather the explicit achievement than the power motive is associated with career performance.

Table 4.15 Multiple regression analyses on the link between percentage of tie breaks won (Tie Breaks %) and implicit (OMT-AP) vs. explicit motives (PRF-AP) of achievement and power ($N = 68$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	-0.01	0.12	
Explicit Motives (PRF-AP)	-0.31	0.12	-.31*
STEP 2			
Constant	-0.02	0.11	
Explicit Motives (PRF-AP)	-0.32	0.12	-.31**
Implicit Motives (OMT-AP)	0.20	0.11	.20†

Note. $R^2 = .09$ for step 1 ($p < .05$), $\Delta R^2 = .04$ for step 2 ($p < .05$). † $p < .10$, * $p < .05$, ** $p < .01$.

In Table 4.14, also, a marginally significant within-subjects effect for the implicit motive component is present. Athletes high in implicit motives perform better in tie breaks than in regular matches compared to athletes low in implicit motives, $F(1,64) = 3.00$, $p < .10$. From Table 4.4, it is known that the implicit power motive (but not the achievement motive) is mildly positively associated with performance in tie breaks as well as improvement in tie breaks compared to regular matches (Δ Tie Breaks – Matches). In Table 4.15, the multiple regression analysis is illustrated for performance in tie breaks. The implicit motive component explains additional variance within the model with $\beta = .20$ ($p < .10$).

Table 4.16 Impact of the congruence of implicit and explicit motives (Δ AP) and affect regulation (PANAR) on the percentages of matches vs. tie breaks won within the past four years ($N = 68$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Motive Congruence (Δ AP)	1	4.12*	.06	.05
Affect Regulation (PANAR)	1	0.52	.01	.47
Δ AP \times PANAR	1	2.93†	.04	.09
Within-group error	64	(1.34)		
Within subjects				
Tie Break – Match	1	0.00	.00	.97
Tie Break – Match \times Δ AP	1	0.25	.00	.62
Tie Break – Match \times PANAR	1	1.26	.02	.27
T – M \times Δ AP \times PANAR	1	0.02	.00	.88
Within-group error	64	(0.53)		

Note. Values enclosed in parentheses represent mean square errors. Tie Break – Match (T – M) denotes the difference between regular match performance in % vs. performance in tie breaks. † $p < .10$.

Additionally, from Table 4.11 it is known that motive congruence is associated with percentages of matches, $R^2 = .07$, $p < .05$, $\Delta R^2 = .05$, $p < .05$, and tie breaks won, $R^2 = .17$, $p < .001$, $\Delta R^2 = .01$, $p < .001$. Better performances in matches are predicted by the *incongruence* of motives at $\beta = .25$ ($p < .05$). Along this line, performances in tie breaks are also predicted very strongly by motive *incongruence* with a $\beta = .42$ ($p < .001$).

.001). Surprisingly, as the standardized beta scores imply, these strong associations with high performance within the past four years are correlated with high *incongruence* between implicit and explicit motives. Especially in critical situations like tie breaks athletes highly benefitted from incongruent motives. This hypothesis was tested by means of an analysis of variance (see Table 4.16). It was found that the factor congruence of implicit and explicit motives (Δ AP) is a significant between-subjects factor for both match and tie-break performances, $F(1, 64) = 4.12$, $\eta^2 = .06$, $p < .05$. Athletes with highly incongruent motives won more matches and tie breaks over the course of four years. Additionally, incongruence of motives interacts with affect regulation ability. Career performance (in matches and tie breaks) of athletes with high incongruence and high ability to regulate affect benefitted most. Congruent motives in combination with high ability to regulate affects lead to the worst performance. Again, opposed to the hypothesized direction, athletes with congruent motives performed worse not only in overtime sets won but also in matches as a whole.

Finally, Table 4.11 suggested that affect and self-regulation abilities predict the improvement from match to tie break performance, $R^2 = .03$, $p = ns$, $\Delta R^2 = .09$, $p < .10$. Beta values for the whole model are given in Table 4.17. The standardized $\beta = .29$ ($p < .05$) suggests self-regulation as a significant predictor for the improvement of tie breaks won in comparison to matches won within the past four years. An analysis of variance was conducted for the interaction of motive congruence and conscious self-regulation (SIVI). A marginal within-subjects effect could be found for the conscious self-regulation component, $F(1,64) = 3.01$, $\eta^2 = .05$, $p < .10$. Data suggest that athletes with a low ability for self-regulation under pressure, paradoxically, perform better in critical situations like tie breaks compared to regular matches. From Table 4.4, it is known that volitional inhibition is positively associated with the change in performance percentages

between tie breaks and matches ($p < .05$). Thus, players who were not able to use their conscious volition in an action-oriented manner perform better in tie breaks.

Table 4.17 Multiple regression analyses on the link between the improvement in percentage of tie breaks won compared to percentage of matches won (Δ Tie-Match) and congruence of implicit and explicit motives (Δ AP), affect regulation abilities (PANAR), and self-regulation abilities (SIVI) ($N = 68$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	-0.03	0.19	
Motive Congruence (Δ AP)	0.03	0.14	.03
STEP 2			
Constant	-0.02	0.19	
Motive Congruence (Δ AP)	0.01	0.14	-.01
Affect Regulation (PANAR)	-0.07	0.12	-.07
Self-Regulation (SIVI)	0.27	0.11	.29*

Note. $R^2 = .03$ for step 1 ($p = ns$), $\Delta R^2 = .09$ for step 2 ($p < .10$). * $p < .05$.

Conclusions. It could be shown that incongruent (power) motive systems lead to higher amounts of practice hours at career highs and present practice loads. Furthermore, athletes high in the implicit power motive practiced more hours at their career highs but less hours at present. As far as findings concern career performances, it can be retained that the explicit achievement motive needs to be low for high performances within the past four years not only in matches played but also in tie-break situations. Additionally, a high implicit power motive seems to help athletes perform well in tie-

break situations. Surprisingly, players seem to benefit from incongruence between the implicit and explicit power motive both in matches as a whole and tie breaks. This advantage for motive incongruence is especially pronounced for athletes with a high ability to regulate negative affect. Finally, conscious volitional inhibition also seems to help athletes perform well in tie breaks.

Implicit vs. Explicit Motivational Processes and Single Game Performance

In Table 4.18, regression models for single performances in the analyzed video-taped games are presented. In analogy to the procedure done for the analysis of career performances it is first tested whether implicit motives are better predictors for overall single game performances compared to explicit motives. Afterwards, it is tested whether motive congruence plus affect regulation and self-regulation are significant predictors of single game performances. Within the latter analysis the second step consists of a comparison of the two regulatory abilities. That is why two analyses of variance needed to be conducted for affect regulation (PANAR, one), and self-regulation (SIVI, two).

Duration of the Match. In Table 4.18 it is illustrated that implicit motives account for additional variance in the regression model for total match time, $R^2 = .01$, $p = \text{ns}$, $\Delta R^2 = .08$, $p = \text{ns}$. The standardized $\beta = -.28$ for the implicit motives ($p < .05$) and non-significant for the explicit motives, $\beta = .08$ ($p = \text{ns}$). Within an ANOVA, the implicit motive component shows a significant impact on the time spent playing, $F(1,48) = 4.79$, $p < .05$. Athletes with low implicit motives play longer matches. From Table 4.6 it is known that the implicit achievement motive but not the power motive is by trend positively associated with match time ($p < .10$). Thus, we can conclude that a high achievement motive leads to longer playing times in this sample.

Table 4.18 Overview on multiple regression analyses conducted on the link between overall game performance and personality variables ($N = 52$)

	Predictors				
Criteria	Step 1	Step 2	R^2	ΔR^2	p
GENERAL					
Match Time (min)	PRF-AP	OMT-AP	.01	.08*	.12
	Δ AP	PANAR, SIVI	.00	.02	.74
Rally Length	PRF-AP	OMT-AP	.00	.02	.59
	Δ AP	PANAR, SIVI	.01	.11†	.12
POINTS WON					
Points Won (%)	PRF-AP	OMT-AP	.04	.07†	.07
	Δ AP	PANAR, SIVI	.01	.01	.74
Points Won Serving (%)	PRF-AP	OMT-AP	.00	.03	.47
	Δ AP	PANAR*, SIVI	.00	.09	.21
Points Won Returning (%)	PRF-AP	OMT-AP	.06†	.05	.06
	Δ AP	PANAR, SIVI	.00	.00	.94
DOMINANT PLAY					
Personal Dominance	PRF-AP	OMT-AP	.10*	.06†	.02
	Δ AP	PANAR, SIVI	.14**	.03	.03

Note. † $p < .10$, * $p < .05$, ** $p < .01$.

Rally Length. Volitional regulatory abilities (affect regulation & self-regulation) seem to be a better predictor of rally length than any of the motivational systems or

their congruence. By trend the ability to regulate affect (PANAR) predicts rally length, $R^2 = .01$, $p = ns$, $\Delta R^2 = .11$, $p = ns$. The standardized $\beta = -.32$ for affect regulation ($p < .05$) and $\beta = .10$ for self-regulation ($p = ns$). Thus, an ANOVA was conducted for the affect regulation, leading to a marginally significant between-subjects effect, $F(1,48) = 3.67$, $p < .10$. It is found that athletes high in the ability to regulate affect played shorter rallies. This finding is supported by correlations illustrated in Table 4.6. Both the ability to regulate positive and negative affect are negatively associated with rally length.

Table 4.19 Multiple regression analyses on the link between the percentage of points won on return (Points Return) and implicit (OMT-AP) as well as explicit motives (PRF-AP) ($N = 52$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	-0.00	0.13	
Explicit Motives (PRF-AP)	-0.25	0.13	-.25†
STEP 2			
Constant	-0.01	0.13	
Explicit Motives (PRF-AP)	-0.25	0.13	-.26†
Implicit Motives (OMT-AP)	-0.21	0.13	-.21

Note. $R^2 = .06$ for step 1 ($p < .10$), $\Delta R^2 = .05$ for step 2 ($p < .10$). † $p < .10$.

Table 4.20 Impact of implicit (OMT-AP) and explicit motives (PRF-AP) on the percentages of points won on return within the single games analyzed ($N = 52$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Explicit Motives (PRF-AP)	1	9.44**	.16	.00
Implicit Motives (OMT-AP)	1	0.13	.00	.72
PRF-AP \times OMT-AP	1	2.44	.05	.13
Within-group error	48	(0.82)		

Note. Values enclosed in parentheses represent mean square errors. ** $p < .01$.

Points Won Overall, on Service, and Return. With regard to points won within the matches analyzed, implicit motives ($\beta = -.26$, $p < .10$) seem to be a better predictor than explicit motives ($\beta = -.19$, $p = \text{ns}$). Although the regression model, $R^2 = .04$, $p = \text{ns}$, $\Delta R^2 = .07$, $p < .10$, is of advantage for the implicit motive component, the analysis of variance clarifies this finding in advantage for the explicit motive. While no significant result can be found for the implicit motive factor, $F(1,48) = 0.00$, $\eta^2 = .00$, $p = \text{ns}$, participants low in the explicit motive component won more points, $F(1,48) = 6.00$, $\eta^2 = .11$, $p < .05$. Looking at Table 4.6 again, we can see that the achievement motive is more strongly associated with overall points won. This correlation is negative. Illustrated in Table 4.19, this finding is further substantiated by the regression model for performance in return games, $R^2 = .06$, $p < .10$, $\Delta R^2 = .05$, $p < .10$. Here again, the explicit motives are a better predictor ($\beta = -.25$, $p < .10$) than the implicit motives ($\beta = -.21$, $p = \text{ns}$). This time, the ANOVA strongly supports the finding, $F(1,48) = 9.44$, $\eta^2 =$

.16, $p < .01$ (see Table 4.20). Taken into account the correlations from Table 4.6, it can be concluded that players with a low explicit achievement motive performed much better on return games.

Table 4.21 Impact of congruence between implicit and explicit motives (Δ AP), and affect regulation (PANAR) on the percentages of points won on service within the single games analyzed ($N = 52$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Motive Congruence (Δ AP)	1	0.00	.00	.95
Affect Regulation (PANAR)	1	3.84†	.07	.06
Δ AP \times PANAR	1	0.01	.00	.94
Within-group error	48	(0.94)		

Note. Values enclosed in parentheses represent mean square errors. † $p < .10$.

For performance on service, regulatory abilities of affect and self-regulation are predictors. Although the regression model is not significant, $R^2 = .00$, $p = \text{ns}$, $\Delta R^2 = .09$, $p = \text{ns}$, affect regulation is significantly related to points won on service ($\beta = .30$, $p < .05$) while self-regulation is not ($\beta = .04$, $p = \text{ns}$). In order to test the hypothesis whether regulatory abilities have an impact on performance on service games, one ANOVA for affect regulation and one ANOVA for self-regulation were conducted (see Tables 4.21 and 4.22). Analyses of variance, $F(1,48) = 3.84$, $\eta^2 = .07$, $p < .10$, suggest that athletes with higher ability to regulate affect (high affect regulation) and athletes with a low ability to access the self under stress (low self-regulation) won more points on service

games, $F(1,48) = 4.88$, $\eta^2 = .09$, $p < .05$. From Table 4.6 we can deduct that the ability to regulate positive affect is more important for a high service performance.

Table 4.22 Impact of congruence between implicit and explicit motives (Δ AP), and self-regulation (SIVI) on the percentages of points won on service within the single games analyzed ($N = 52$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Motive Congruence (Δ AP)	1	0.05	.00	.83
Self-Regulation (SIVI)	1	4.88*	.09	.03
Δ AP \times SIVI	1	0.19	.00	.66
Within-group error	48	(0.92)		

Note. Values enclosed in parentheses represent mean square errors. * $p < .05$.

Dominant Play. Both explicit and implicit motives are predictors of dominant play, $R^2 = .10$, $p < .05$, $\Delta R^2 = .06$, $p < .05$. Values for the regression model are given in Table 4.23. It is apparent that explicit motives ($\beta = -.31$, $p < .05$) are a better predictor of dominance within the game than implicit motives ($\beta = -.24$, $p < .10$). This result was confirmed by the ANOVA conducted, $F(1,48) = 2.83$, $\eta^2 = .06$, $p < .10$. Consequently, taking into account results from Table 4.6, athletes with a low explicit achievement motive reported higher dominance scores. Furthermore, displayed in Table 4.24, an interaction effect between explicit and implicit motives is found, $F(1,48) = 8.07$, $\eta^2 = .14$, $p < .01$. Thus, athletes with incongruent motives (high implicit plus low explicit, or low implicit plus high explicit) reported higher dominance scores. This finding is in line with

the regression model, $R^2 = .14$, $p < .01$, $\Delta R^2 = .03$, $p < .05$, for motive congruence on dominance (see Table 4.17). Herein, the congruence score between implicit and explicit motives is a significant predictor of dominant play ($\beta = .37$, $p < .01$). In an ANOVA this finding can be confirmed repeatedly with a moderate effect size, $F(1,48) = 8.54$, $\eta^2 = .15$, $p < .01$: Athletes with highly incongruent power motives played more dominantly according to self-reports.

Table 4.23 Multiple regression analyses on the link between the self-evaluation of dominant play (Dominance) and implicit (OMT-AP) as well as explicit motives (PRF-AP) ($N = 52$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	-0.01	0.13	
Explicit Motives (PRF-AP)	-0.30	0.13	-.31*
STEP 2			
Constant	-0.01	0.13	
Explicit Motives (PRF-AP)	-0.31	0.13	-.32*
Implicit Motives (OMT-AP)	-0.23	0.13	-.24†

Note. $R^2 = .10$ for step 1 ($p < .05$), $\Delta R^2 = .06$ for step 2 ($p < .05$). † $p < .10$, * $p < .05$.

Table 4.24 Impact of implicit (OMT-AP) and explicit motives (PRF-AP) on self-evaluations of dominant play within the single games analyzed ($N = 52$)

Source	df	F	η^2	p
Between subjects				
Explicit Motives (PRF-AP)	1	2.83†	.06	.10
Implicit Motives (OMT-AP)	1	0.22	.00	.65
PRF-AP \times OMT-AP	1	8.07**	.14	.01
Within-group error	48	(0.82)		

Note. Values enclosed in parentheses represent mean square errors. † $p < .10$, ** $p < .01$.

Conclusions. Thematically, the achievement motive seems to have a stronger impact on overall single game performance than the power motive. Findings suggest that athletes with a low explicit achievement motive perform better in matches at a whole, which seems to be connected to their advantages in performance in return situations. On the contrary, the implicit achievement motive, by trend, needs to be high in order to support athletes' overall performance. Additionally, players with a high implicit achievement motive take more time playing their matches. By self-evaluation, a low explicit achievement motive supports dominant play. Further, it can be concluded that athletes with incongruent power motives play more dominantly than players with congruent motives. For a good service game a high ability to regulate positive affect as well as a low ability for conscious self-regulation help athletes. Finally, a high ability to regulate both positive and negative affects leads to shorter rallies.

Table 4.25 Overview on multiple regression analyses conducted on the link between performance in consciously critical situations compared to non-critical situations (Δ Consciously Critical) and the respective unconsciously critical situations (Δ Unconsciously Critical) and personality variable components ($N = 52$)

	Predictors				
Criteria	Step 1	Step 2	R^2	ΔR^2	p
POINTS WON					
Δ Consciously Critical	OMT-AP	PRF-AP	.02	.10*	.04
	Δ AP	PANAR, SIVI**	.02	.18*	.01
Δ Unconsciously Critical	PRF-AP	OMT-AP	.00	.12*	.04
	Δ AP	PANAR, SIVI	.02	.02	.63
MEAN RALLY LENGTH					
Δ Consciously Critical	OMT-AP	PRF-AP	.02	.00	.63
	Δ AP	PANAR, SIVI	.00	.06	.40
Δ Unconsciously Critical	PRF-AP	OMT-AP	.03	.01	.43
	Δ AP	PANAR, SIVI	.04	.00	.57
SD RALLY LENGTH					
Δ Consciously Critical	OMT-AP	PRF-AP	.00	.01	.75
	Δ AP	PANAR, SIVI	.00	.03	.71
Δ Unconsciously Critical	PRF-AP	OMT-AP	.00	.01	.86
	Δ AP	PANAR, SIVI	.10*	.00	.16

Note. * $p < .05$.

Implicit vs. Explicit Motivational Processes and Performance in Unconsciously vs. Consciously Critical Situations

In this section, behavior and performance data are compared for two types of critical situations: consciously vs. unconsciously critical situations. It is assumed that in consciously critical situations, explicit mental processes like explicit motives and conscious self-regulation are better predictors of performance than implicit motivational processes. In contrast, in unconsciously critical situations, implicit motives, and interaction between motive congruence and affect regulation are expected to be better predictors for performance compared to explicit processes. In accordance with these assumptions, regression models are designed. As previously done, analyses of variance are conducted to follow up regression analyses. Table 4.25 (ahead) gives an overview of the regression analyses performed.

Points Won. In order to dissociate performance in subjectively critical situations from performance in objectively critical situations, two regression models are looked at and an analysis of variance was conducted. From Table 4.25, we can see that explicit motives ($\beta = -.32$, $p < .05$) predict the improvement in performance (points won) from non-critical to consciously critical situations better than implicit motives ($\beta = .14$, $p = ns$). In Table 4.26, the full regression model can be found, $R^2 = .02$, $p = ns$, $\Delta R^2 = .10$, $p < .05$. On the contrary, the performance in unconsciously critical situations compared to non-critical situations can be better predicted by implicit motives ($\beta = -.35$, $p < .05$) than by explicit motives ($\beta = -.05$, $p = ns$). This regression model can be found in Table 4.27, $R^2 = .00$, $p = ns$, $\Delta R^2 = .12$, $p < .05$.

Table 4.26 Multiple regression analyses on the link between the increase in points won in consciously critical situations compared to non-critical situations and implicit (OMT-AP) vs. explicit motives (PRF-AP) ($N = 52$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	0.00	0.14	
Implicit Motives (OMT-AP)	0.14	0.14	.14
STEP 2			
Constant	-0.00	0.13	
Implicit Motives (OMT-AP)	0.13	0.13	.13
Explicit Motives (PRF-AP)	-0.31	0.13	-.32*

Note. $R^2 = .02$ for step 1 ($p = ns$), $\Delta R^2 = .10$ for step 2 ($p < .05$). * $p < .05$.

To test the hypothesis whether athletes high in explicit motives benefit in conscious critical situations while athletes high in implicit motives perform better in unconscious critical situations an ANOVA is administered (see Table 4.28). It could be found that a low explicit motive is beneficial in both critical situations, $F(1,48) = 6.79$, $\eta^2 = .12$, $p < .05$. Besides this between-subjects effect, there is also a within-subjects effect, $F(1,48) = 4.30$, $\eta^2 = .08$, $p < .05$: Athletes low in the implicit motive component perform better in unconsciously critical situations compared to consciously critical situations. If we turn to Table 4.8, we will find that in accordance with the implicit motive component the power motive is negatively associated with points won in unconscious critical situations. At the same level the implicit achievement motive is positively correlated with performance in unconsciously critical situations. This means that both athletes high in

the implicit achievement motive and athletes low in the implicit power motive perform better in unconsciously critical situations. Furthermore, Table 4.8 tells us that the explicit achievement motive is negatively associated with points won in consciously critical situations. Thus, players low in the explicit achievement motive benefit from it in consciously critical situations.

Table 4.27 Multiple regression analyses on the link between the increase in points won in unconsciously critical situations compared to non-critical situations and implicit (OMT-AP) vs. explicit motives (PRF-AP) ($N = 52$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	0.00	0.14	
Explicit Motives (PRF-AP)	-0.05	0.14	-.05
STEP 2			
Constant	-0.00	0.13	
Explicit Motives (PRF-AP)	-0.06	0.13	-.06
Implicit Motives (OMT-AP)	-0.34	0.13	-.35*

Note. $R^2 = .00$ for step 1 ($p = ns$), $\Delta R^2 = .12$ for step 2 ($p < .05$). * $p < .05$.

Neither the congruence of motives ($\beta = .17$, $p = ns$), nor the affect regulation ability ($\beta = .17$, $p = ns$) are predictors for points won in any critical situation (see Table 4.25). No differences are found for athletes high vs. low in affect regulation within an analysis of variance ($ps = ns$).

Table 4.28 Impact of implicit motives (OMT-AP) and explicit motives (PRF-AP) on the percentages of points won in consciously (CON) vs. unconsciously critical situations (UN) within the single matches analyzed ($N = 52$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Explicit Motives (PRF-AP)	1	6.79*	.12	.01
Implicit Motives (OMT-AP)	1	0.00	.00	.98
PRF-AP \times OMT-AP	1	2.55	.05	.12
Within-group error	48	(0.99)		
Within subjects				
Critical Situation	1	0.00	.00	.99
Critical Situation \times PRF-AP	1	0.36	.01	.55
Critical Situation \times OMT-AP	1	4.30*	.08	.04
CS \times PRF-AP \times OMT-AP	1	0.01	.00	.94
Within-group error	48	(0.79)		

Note. Values enclosed in parentheses represent mean square errors. Critical Situation (CS) denounces the difference in the percentage of points won in consciously vs. unconsciously critical situations. * $p < .05$.

However, conscious self-regulation is positively associated ($\beta = .38$, $p < .01$) with the increase in performance in consciously critical situations (see Table 4.29). In an analysis of variance, a between-subjects interaction effect is found for motive congruence and self-regulation, $F(1,48) = 7.42$, $\eta^2 = .13$, $p < .01$ (see Table 4.30). Surprisingly, athletes whose motives are congruent and who are able to consciously access

their self under stress perform worse in both critical situations. This group should theoretically benefit from motive congruence and conscious self-regulation under pressure. Yet best results in both critical situations are found for athletes who show congruent motives and do not have good self-access under stress. Interestingly, for athletes with incongruent motives the self-regulation abilities do not play a role. Either way, they play at a mediocre level. Thus for critical situations (independent of whether athletes perceive it as consciously critical or not) motive incongruence seems to help avoid performance slumps. Furthermore, players benefit from a low self-regulation independent of what kind of critical situation they are in, $F(1,48) = 6.30, \eta^2 = .12, p < .01$. However, low self-regulation helps players much more in consciously than in unconsciously critical situations, $F(1,48) = 8.67, \eta^2 = .15, p < .01$.

Mean Rally Length. Mean rally length could neither be predicted by the explicit nor the implicit motive component in any of the two critical situations (see Table 4.25). Furthermore, an ANOVA conducted could not find differences between athletes high or low in both explicit and implicit motives for the performance in different critical situations, $ps = ns$. Motive congruence as well as affect and self-regulation abilities are also no predictors for rally length in different critical situations (see Table 4.25). The ANOVA does not show significant differences for any of the personality variables ($ps = ns$).

Variance in Rally Length. Explicit and implicit motives are no predictors of the standard deviation in rally length for any critical situation (see Table 4.25). Analysis of variance displayed no differences for players with high vs. low explicit and implicit motives for consciously and unconsciously critical situations ($ps = ns$). According to Table 4.25, motive congruence is a significant predictor ($\beta = -.32, p < .05$) of the variance in rally length but affect ($\beta = -.00, p = ns$) as well as self-regulation ($\beta = -.04, p = ns$) are not, $R^2 = .10, p < .05, \Delta R^2 = .00, p = ns$. However, this effect could not be substantiated by means of variance of analysis ($ps = ns$).

Table 4.29 Multiple regression analyses on the link between the increase in points won in consciously critical situations compared to non-critical situations and the congruence of implicit and explicit motives (Δ AP) as well as self-regulation (SIVI) ($N = 52$)

Criteria	<i>B</i>	<i>SE B</i>	β
STEP 1			
Constant	-0.17	0.21	
Motive Congruence (Δ AP)	0.15	0.15	.14
STEP 2			
Constant	-0.24	0.20	
Motive Congruence (Δ AP)	0.18	0.14	.17
Affect Regulation (PANAR)	0.17	0.13	.17
Self-Regulation (SIVI)	0.35	0.12	.38**

Note. $R^2 = .02$ for step 1 ($p = ns$), $\Delta R^2 = .18$ for step 2 ($p < .01$). ** $p < .01$.

Conclusions. When it comes to critical situations a low explicit achievement motive should help racquet players perform better. Especially in consciously critical situations players benefit from a low explicit achievement motive. In contrast, in unconscious critical situations, players with a high implicit achievement or a low implicit power motive win more points. Additionally, in the present sample, the performance of athletes with incongruent motives suffers least in any critical situation. However, when players exhibit congruent motives and at the same time show reduced conscious self-access under stress (low self-regulation) their performance is best in both consciously and unconsciously critical situations. Yet, if congruent motives are paired with high conscious self access players will experience greatest performance slumps. Regard-

less of what type of critical situations racquet players are in they tend to benefit from reduced self-access under stress. No inferences could be made on changes made regarding the length of rallies played in critical situations. Nevertheless, a regression analysis suggests that motive congruence is associated with higher rally variance in unconsciously critical situations. Since questionnaires were administered prior to the individual games recorded, inferences could still be made from this result.

Finally, the analyses of career data on tie breaks paint a more precise picture on thematic differences for the performance in critical situations. Within the past four years, the implicit *power* motive has played a more important role for athletes' performances in tie breaks. This might be due to the fact that athletes performed within a situation in which their performance was clearly connected to the outcome of the set (winning or losing it). In the unconsciously critical situations within the games recorded, however, they basically played to perform well. It could be expected that this performance is rather predicted by the implicit *achievement* motive.

Discussion

By adding two personality measures of implicit vs. explicit motives as well as conscious self-regulation to the research design and discriminating consciously from unconsciously critical situations many findings could be produced that center more or less around the title of the present work. It should be reminded of the exploratory character of the third study for the area of sport psychology. In the past, seldom, it has been tried to investigate the discriminant validity of implicit vs. explicit motive measures in sports settings (e.g., Gabler, 1972). In order to organize all results and give a broad overview to the findings, Figure 4.3 was created. The following paragraphs recapitulate the most important findings of study three.

Table 4.30 Impact of congruence of implicit and explicit motives (Δ AP) and self-regulation (SIVI) on percentages of points won in consciously (CON) vs. unconsciously critical situations (UN) in the matches analyzed ($N = 52$)

Source	<i>df</i>	<i>F</i>	η^2	<i>p</i>
Between subjects				
Motive Congruence (Δ AP)	1	2.74	.05	.10
Self-Regulation (SIVI)	1	6.30*	.12	.02
Δ AP \times SIVI	1	7.42**	.13	.01
Within-group error	48	(0.91)		
Within subjects				
Critical Situation	1	0.15	.00	.70
Critical Situation \times Δ AP	1	0.01	.00	.91
Critical Situation \times SIVI	1	8.67**	.15	.01
CS \times Δ AP \times SIVI	1	0.29	.01	.59
Within-group error	48	(0.72)		

Note. Values enclosed in parentheses represent mean square errors. Critical Situation (CS) denotes the difference of points won (in %) in consciously vs. unconsciously critical situations. * $p < .05$, ** $p < .01$.

Consciously vs. Unconsciously Critical Situations. Regarding the central hypotheses of performances in critical situations, in the third study, it is tried to discriminate performances in consciously critical situations from performances in unconsciously critical situations. This is done since study one and two left open whether high (implicit processing) or low (explicit processing) abilities to regulate affect are beneficial

for performances in critical situations. From the first two studies, it could only be concluded that affect regulation has an impact on performances in *objectively* critical situations. In tennis (study one), explicit processing is beneficial, in basketball (study two), implicit processing. However, it remained unclear whether participants were consciously aware of the criticality of the situations or not. In study three, it was possible to determine whether an athlete was consciously aware of a critical situation or not. Unfortunately, in contrast to study one and two results from study three suggest no major impact of the ability to regulate positive or negative affect on performances in either consciously or unconsciously critical situations.

Nevertheless, support is found for the hypothesis that explicit processes predict behavior in consciously critical situations while implicit processes predict behavior in unconsciously critical situations. Namely, implicit motives are able to predict performance in unconsciously critical situations within the single games recorded that could not be predicted by explicit motives (see Tables 4.27 and 4.28). In contrast, explicit motives are able to predict performance in consciously critical situations of the games recorded while implicit motives are not able to do so (see Table 4.26). However, when a factorial design is applied it is shown that racquet sportsmen benefit from explicit motives no matter what kind of critical situation they are in.

Surprisingly, the explicit motive component is negatively associated with performance in (conscious) critical situations. This means that the lower the explicit motive of a tennis, table tennis, or badminton player is the better his performance will be in critical situations. This finding is in contrast to the expectations of this study and other findings on the explicit achievement motive (Elbe, Wenhold, et al., 2005). Yet, as expected, the correlation of the implicit motive with performances in unconsciously critical situations is positive.

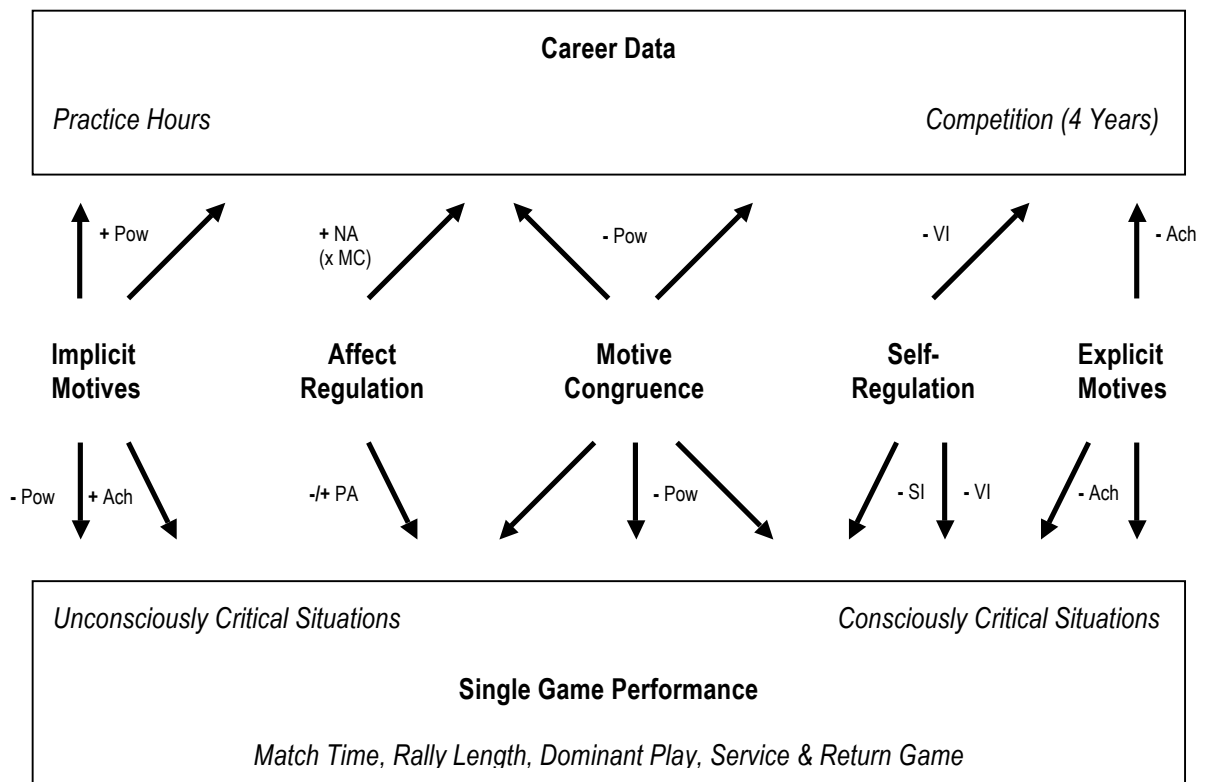


Figure 4.3 Overview of associations found between personality variables of implicit vs. explicit motives and affect as well as self-regulation with behavior on career level as well as in the single recorded games divided by consciously and unconsciously critical situations.

Note. +: positive correlations, -: negative correlations, -/+: both, negative and positive correlations, x: interaction effects of two variables; Pow: power motive, Ach: achievement motive, PA: positive affect regulation, NA: negative affect regulation, MC: motive congruence, SI: self-inhibition, VI: volitional inhibition.

Achievement vs. Power Theme. Thematically, it seems to be the achievement motive that is primarily of value for predicting performances in critical situations. On the implicit side, the achievement motive is positively associated with performances in unconsciously critical situations and general match time. However, since the implicit component resulting from factor analysis is composed of the achievement and the power motive, which are reversely correlated, the implicit power motive is negatively associated with performance in unconsciously critical situations (Table 4.8). It can be further questioned why the implicit achievement motive is associated with uncon-

sciously critical situations but the implicit power motive is associated with tie-break performances. This may be due to the format of the respective task at hand: In tie-break situations a concrete performance goal can be attained. This might be a more tempting stimulus for the power motive. In contrast, in unconscious critical situations there are several situations without a concrete end and these are spread all over a set. Here, the mastery goal of just playing well without a further stimulus could trigger the achievement motive. Although both explicit motives (achievement and power) are negatively associated with performance the correlation of the achievement motive is more pronounced (Table 4.8). Looking at Figure 4.3, it can be seen that inferential statistics rather point to the explicit achievement motive as a predictor not only for conscious critical situations but also for performances in return games (Tables 4.19 and 4.20), self reports on dominant play (Tables 4.23 and 4.24) as well as four-years performance in matches and tie-breaks won (Tables 4.14 and 4.15). Noticeably, these associations are always negative. In contrast, for the implicit motive component the power motive dominantly predicts behavioral variables, especially for career performances (cf. Table 4.4). As such it is associated with a higher amount of practice hours at career high when compared to the present amount (Table 4.12). Furthermore, the implicit power motive is associated with performances in tie breaks over the past four years (Tables 4.14 and 4.15).

Implicit vs. Explicit Motives. As illustrated in Figure 4.3 the inclusion of measures of implicit motives contributes enormously to the prediction of actual athletic behavior. In the present study especially, long-term practice behavior can only be predicted because indirect motivational measures are used. This could be of primary value since a high amount of practice hours is a crucial precondition for expertise in sport (cf. Helsen, Starkes, & Hodges, 1998). As mentioned before, the implicit power motive is not only able to predict highest amounts of practice hours compared to present amount of practice hours. It is also associated with four-year tie-break performance. Unexpect-

edly, an explicit motive measure is also able to predict the performance of racquet sportsmen over the course of four years: a low explicit achievement motive that predicts both performance in tie breaks as well as overall match performance.

Motive Congruence. Also, in contrast to our expectations (cf. Brunstein, 2010; Schüler, 2008), not motive congruence but motive incongruence is associated with long-term athletic behavior as well as different aspects of performances in the games recorded. Incongruent motives not only predict the present amount of practice hours but also the highest amount practiced within the career (Table 4.13). Moreover, the performance in matches as well as tie breaks within the past four years is predicted by incongruent motives (Table 4.16). Furthermore, in the single games recorded motive incongruence is not only of predictive value for self-reports of dominance (Table 4.24) but also for performance in consciously as well as unconsciously critical situations (Table 4.30).

Conscious Self-Regulation. As mentioned above, the Action Control Scale (ACS-90; J. Kuhl, 1994) as a means of the assessment of affect regulation measure unconscious *and* conscious processes of affect regulation. When affect regulation is low explicit forms of information processing are activated. In contrast, when affect regulation is high, the focus is on implicit information processing. In study three, consciously and unconsciously critical situations are discriminated. Affect regulation did not predict any performance in either of the situations. However, adding a measure of conscious volition like self-regulation led to significant results in predicting performance in critical situations. Theoretically this conscious inhibition of self-regulation is accompanied by an activation of the perception of discrepant information by the system of object recognition (OR) and a cross activation of mechanisms of planning in the intention memory (IM) (cf. J. Kuhl, 2000a). When athletes consciously activated these explicit processing systems in study three they were more successful in tie breaks compared to regular matches (cf. Table 4.4 and 4.17). Moreover, they showed better performances in criti-

cal situations in general (Table 4.30). However, in consciously critical situations advantages were more pronounced (see Table 4.8). Also, activation of explicit volitional systems (OR and IM) seems to support performances in service games (Table 4.22). Insofar, results from study three confirm findings from study one which suggest that explicit information processing is of beneficial to the athletes in tie breaks. Actually, this result gives us more insight into how the process of affect regulation is managed in racquet sports – namely consciously. So racquet players use conscious volitional ways of activating the appropriate cognitive system. It could be argued that athletes high in self-inhibition are better at analyzing the opponent's positioning and difficulties with services played earlier in the game. This fits in with McPherson's (2000) categorization of tennis as a high-strategy sport, in which analyzing the game and constantly adjusting match plans is of crucial importance (McPherson & Thomas, 1989).

GENERAL DISCUSSION

Interpretation of Central Results

In the beginning of this final section the central findings of the three studies are discussed from a theoretical point of view and concerning their practical implications. The thematic headline is always followed by a brief summary of the empirical results from studies one to three. Afterwards, these results are discussed.

Consciously vs. Unconsciously Critical Situations. If researchers want to predict athletic behavior in critical sport situations from psychological dispositions they need to operationalize carefully.

In study one critical situations were determined according to the *subjective* judgment of the athletes. This definition is in line with researchers who assume that critical situations put stress on an individual exceeding his or her capacity of conscious, cognitive coping (Lazarus & Folkman, 1984). For example, video-confrontation techniques are used to help athletes in recalling situations that were especially new or uncertain to them or were associated with bad timing (e.g., Knisel, 2003). In the first study of this work, athletes were interviewed as to critical situations they experienced right after the game had ended. Unfortunately, the ability to regulate affect is not a good predictor for performance in such situations. Other researchers, despite having the same theoretical background, avoid the athletes' perspective and set critical situations according to unusual match events (Krohne & Hindel, 1988), structural aspects of close games (Bar-Eli, et al., 1992; Bar-Eli & Tenenbaum, 1989; Bar-Eli & Tractinsky, 2000), or other athletic competitions (Schüler & Langens, 2007), or use expert ratings (Carlstedt, 2004a). In line with this research, study two uses an *objective* definition of critical situations independent of athletes' subjective awareness. However, using this approach leaves a researcher uninformed about the subjective awareness and raises

the question whether a certain situation is stressful to the individual at all. In study two critical situations are objectively set in line with the definition of Bar-Eli (Bar-Eli & Tractinsky, 2000). Here, affect regulation abilities could also not predict performances. Yet, common to both studies one and two is that affect regulation is able to predict performance in more broadly defined critical situations. When looking at tie-break performances throughout a tennis player's career, in study one low affect regulation (explicit processing) is of predictive value. Similarly, looking at the performance in close games over a whole season, in study two high affect regulation (implicit processing) is able to predict athletes' free throw percentage and defensive rebounding performance. Actually, from a practical perspective for sports science, these less narrow definitions of critical situations are very valuable. However, in both studies critical situations are still objective and nothing is known about whether athletes may use cognitive or affective means of coping within these stressful situations. In order to be able to give advice for sportsmen, however, it must be known what competencies need to be trained in order to improve performances in critical situations.

That is why, in study three the attempt is made to more specifically define critical situations depending on whether an athlete is or is not consciously aware of the criticality of a situation. As a basis, comparable to study two, a definition of an objective critical situation (Krohne & Hindel, 1988) was used that is applicable to different racket sports. Additionally, similarly to study one athletes were asked for subjectively critical situations. This combination of the approaches of study one and two results in a more controlled definition of what kind of critical situations is discussed. A subjective critical situations in this sense fulfills Bargh's (1994) definition of consciousness since athletes are aware of the concept of criticality as defined by the researcher and may identify the effects these situations can cause. Furthermore, if it is accepted that an objectively critical situation in the sense of Krohne and Hindel (Krohne & Hindel, 1988) is stressful to the athlete then the fact that the athlete will not identify a certain situation

points to his unawareness of the criticality. Thus, unconsciousness as defined by Bargh (1994) must be assumed.

Indeed, in study three affect regulation is not associated with any performance measure in either consciously or unconsciously critical situations. Insofar, both findings from study one and two could be replicated for the narrowly defined consciously and unconsciously critical situations. However, implicit as well as explicit motives are able to predict competitive behavior in the theoretically assumed direction; even in these narrowly set critical situations. In study three explicit processes of volition and motivation could primarily predict performance in consciously critical situations. As to Landers and Arent (2006), the sport of tennis has a lower optimum arousal level (some arousal) than basketball (medium arousal). Arguing with Metcalfe and Mischel (1999), under low to medium arousal levels (like in tennis) explicit processing should primarily guide behavior since time is given to process information sequentially. In contrast, at medium to high levels of arousal (like in basketball) the implicit system will take over and exert stronger influence over performance. Results from the three studies can be easily aligned to previous research findings. Performance in tie-break situations in study one, for example, could be predicted by explicit processes of affect regulation. This can be assumed to be in line with Metcalfe and Mischel (1999). Of all the points played within the tie-breaks of the matches recorded, only one third of the points were named as being consciously critical. That means that athletes were not extremely aroused in tie breaks. Since tennis is a low to medium arousal sport, players will easily be able to process information explicitly, even in tie breaks. Additionally, individuals who usually process stress with the help of explicit processing systems should have performance advantages in such situations (Baumann & Kuhl, 2002). In study three, for example, explicit motives can be used to predict performance in consciously critical situations. Thus, explicit motives may be more effective when the respective situations are consciously perceived. In contrast, in the same study, implicit motives are only associated

with performance when the athletes are not conscious of critical situations. This is also in accordance with Schultheiss' model of implicit and explicit motives. Therein, implicit motives are triggered by nonverbal stimuli and explicit motives are triggered by verbal stimuli (Schultheiss, 2008). Specificity of stimuli for the respective information-processing system was also addressed by Smith and DeCoster (2000). In study two, close games in basketball are usually more intensive and arousing than regular games. Since basketball on average is already medium to high arousing close games should thus put even more stress on a player. Consequently it can be assumed with Metcalfe and Mischel (1999) that implicit processes may have a greater impact on behavior in close games in basketball. Results from all three studies can insofar be discussed from a perspective of specificity – when stimuli are consciously processed and arousal levels allow explicit processing respective psychological measure are more valuable. However, when arousal levels are high or not consciously perceived implicit processes are preferably for predicting athletic behavior.

Implicit Motivational Processes and Long-Term Athletic Behavior. Long-term athletic behavior like higher ATP rankings in tennis, or the maximum amount of practice hours over the course of the career, and tie breaks won within the past four years in racquet sports as well as field goal percentages and the amount of defensive rebounds over the course of a whole basketball season can possibly be predicted because implicit measures have been included in the research.

In study three, performances in tie breaks over the past four years could be linked to implicit motives, especially the power motive. Similar results were put forward for high performance swimmers (Gabler, 1972). In this study, a high implicit achievement motive was associated with higher amounts of practice hours and a better personal best time as well. This is also in accordance with traditional findings which suggest that success in the professional sector and entrepreneurship depends on the implicit power and achievement motive (McClelland, 1961; McClelland & Boyatzis, 1982;

McClelland & Franz, 1992). Moreover, the implicit motive component (alone or in combination with the explicit component) could be linked to higher amounts of maximum practice hours throughout the career compared to the present amount of practice hours. This is again in line with Gabler's (1972) finding in high performance swimmers. Furthermore, this finding can be linked to research from motivational psychology that suggests that implicit motives particularly predict the effort put into given tasks (Brunstein & Hoyer, 2002). More *effort* put into practice is a crucial precondition for becoming a successful high performance athlete. The theory of deliberate practice proposes that a certain amount of practice hours is needed in order to become an expert in a field like sport (cf. Helsen, et al., 1998). Interestingly, high achievement-motivated athletes in study three have longer playing times (cf. Table 4.6). This could be another hint to a high standard of excellence and heightened effort exerted on a given task by achievement-motivated athletes.

Athletes with the ability to regulate affect prefer implicit forms of information processing. Not least, affect regulation is associated with implicit motives but not with explicit ones. In study two it could be shown that over the course of a whole season basketball players with a high ability to regulate positive affect (focus on intuitive behavior control) score more field goals than athletes who prefer explicit processing. Descriptive data in study two showed that basketball players display a higher mean score for regulation of positive affect compared to a norm sample. This finding is in line with several authors who could repeatedly show that basketball players have higher affect regulation abilities (for an overview, see Beckmann & Kazén, 1994).

Explicit Motives and Competitive Performance. Explicit information processes can be used to predict match and tie-break performances over the past four years in racquet sports and, additionally, tie-break performances for the whole career in tennis. Moreover, explicit self-regulation processes lead to better results in tie breaks and when serving in racquet sports.

The explicit achievement motive is a predictor for the percentage of tie breaks and matches won within the past four years for racquet sportsmen in study three. Although similar results have been documented before (Elbe, Wenhold, et al., 2005), in the research presented here, the achievement motive is inversely related to performance measures. This result must especially be discussed in the light of growing acceptance and application of sport psychological measures in high performance sport practice. Sometimes when athletes are picked for regional or national teams a direct measure of the achievement motive tips the scale between two athletes with similar technical, tactical, and fitness levels. Unexpectedly, from the results in study three it should be concluded that not the tennis player with a higher but with a lower explicit achievement motive should be preferred.

Also, in study one the explicit affect regulation processes (state orientation) are associated with better tie-break performance over course of a career in tennis. Additionally, conscious self-regulation abilities are strongly related to tie-break performance and a higher percentage of points won when serving (study three). As mentioned before, tennis is a less arousing game than for example basketball (Landers & Arent, 2006). Furthermore, tie breaks are not always perceived as subjectively critical (stressful). That is why it is found that both implicit and explicit motives can be used to predict tie-break performances in study three. Explicit motives may consequently be effective in tie-break situations in tennis since arousal levels could still be low (Metcalf & Mischel, 1999). Contrastingly, in team sports like basketball similar positive associations with long-term behavior could not be found and are not expected by the author. Summarizing findings on tie-break performances it must be admitted that explicit motives and explicit self-regulation processes overall are overall more predictive than implicit motives in racquet sports. This seems to be due to a strong activation of cognitive systems that support recognition of discrepant information (OR) and planning (IM). Us-

ing these systems seems to result in beneficial goal setting and attainment within critical situations like tie breaks.

Additionally, the explicit achievement motive is a better predictor of a self-report measure of dominant play in the single racquet games recorded. Since the dominance measure has a direct, verbal format this correlation is expected (Schultheiss, 2008).

Self-Regulation vs. Affect Regulation. Self-regulation strongly determines athletic behavior in critical situations of racquet sports and is associated with performance in service games. Affect regulation influences performances in tie breaks over the course of a tennis career as well as shooting percentages within a whole season in basketball.

Both processes describe volitional abilities – self-regulation points to the way in which regulation is realized consciously while affect regulation plainly answers the question *whether* or not affect regulation takes place. Affect regulation can be done consciously as well as unconsciously. Only in study three both measures are used within one research design. Although in study one low affect regulation (explicit) is able to predict career tie-break performances, and in study two high affect regulation (implicit) is associated with better shooting percentages in basketball within a whole season, in study three, affect regulation is not significantly related to performance in any critical situation. Instead, the conscious volitional ability for self-regulation is important. In critical situations (no matter whether consciously or unconsciously) and when serving, low self-regulation predicts performance. Athletes seem to consciously use explicit processes of object recognition (OR) to promote their match performance. In other words, they may try to analyze thoroughly how their opponent plays and make use of this knowledge when playing critical situations. As discussed before tennis is characterized as a high-strategy sport in which match plans play an important role (McPherson, 2000). Furthermore, using more deliberate, cognitive processes in tie breaks could be functional since for difficult intentions deliberate plans are needed

(Gollwitzer, 1999). Again, explicit self-regulation processes can only exert their influence on competition in tennis since arousal levels allow conscious processes to be effective (Landers & Arent, 2006; Metcalfe & Mischel, 1999).

It must be pointed to another aspect on why low affect regulation (state orientation) may be effective in tie-break situations. From other studies it is known that the majority of points won within a tennis match is due to opponent's unforced errors (cf. Lames, 1991; M. Wegner, 2006). Now, state-oriented players, especially those low in positive affect regulation, hesitate in goal attainment (Beckmann & Kazén, 1994; Roth & Strang, 1994). Also, all players generally show performance impairments in tie breaks compared to regular matches (cf. study one and three). If state-oriented players in critical situations avoid making a decision in the rally they will at the same time force their opponents to make these decisions. Consequently, the opponent will make more mistakes than the state-oriented player. This may be the cause for better performances compared to action-oriented players. In study three, namely, it could be shown that state-orientation is associated with longer rallies but action-orientation with shorter rallies in racquet sports.

Incongruence of Implicit and Explicit Motives. Incongruent explicit and implicit power motives are associated with long-term athletic behavior such as the amount of practice hours at career high and at present as well as performances in matches and tie breaks over the past four years. Furthermore, in critical situations incongruent motives predict performances independent of whether they are perceived consciously or not.

From motivational research it is known that congruent implicit and explicit motives are related to emotional well-being (for an overview, see Brunstein, 2008, 2010), which is assumed to affect long-term behavior and increase performance under stress (Code & Langan-Fox, 2001). Research on motive congruence in the sports field is rare. However, congruent motives were related to higher flow experiences in the exercise

context (Schüler, 2010). Flow is in turn associated with better sports performances in cycling, orienteering, or life saving (S. A. Jackson, 2001). Moreover, in motivational psychology, the flow concept could be related to better results in a statistics class as well as better performance in a computer game (Engeser & Rheinberg, 2008). However, results found in study three point in the opposite direction. Incongruence in tennis is related to long-term practice and match behavior. Results of two of the three studies reported in this work slightly reflect the incongruence between explicit and implicit information processes at least for tennis players. As previously illustrated, ATP rankings and the percentage of matches won (study one) and the amount of practice hours (study three) work at least at a descriptive level in favor of high affect-regulating and implicitly motivated athletes (implicit processing). In contrast, many of the performance measures (performance in matches, tie breaks, critical situations, on service) are linked to explicit processes. Thus, it could be speculated whether incongruent motives are adaptive in tennis (racquet sport) because meta-tasks contributing to progress on a career level need implicit information processes. This could be related to being able to adapt to new circumstances, implementing set goals (like finding a valuable tournament abroad) into action, and practicing day in and day out. These meta-abilities might be important to becoming a successful athlete in racquet sports. In contrast, actual performance in the game preferably needs explicit information processing. If an athlete is good in organizing his athletic career (strong implicit processing) he would probably fail in the actual performance task – playing tennis. By contrast, if someone is a good tennis performer (strong explicit processing) he may fail at organizing all the things that go along with professional tennis. Thus, it could be of importance to have a good balance between both information-processing systems.

For example, Langan-Fox and colleagues identified competencies like self-directedness, self-disclosure, or a beneficial locus of control as moderators that could compensate the negative effects of incongruent motives (Langan-Fox, Sankey, &

Canty, 2009). From the present data and research documentation no further explanations for the beneficial effect of incongruent motives on long-term behavior and performance under stress in tennis can be made. Recent research on the preconditions for the development of incongruent motives from childhood (Schattke, Koestner, & Kehr, 2011) may help to find reasons for these findings that are not in line with present theory. However, findings on extremely negative emotional states of elite tennis athletes may be a sign that in the long run an extreme gap between explicit and implicit motives may not be beneficial to the players' health (Butt & Cox, 1992). At earlier stages of a tennis player's career, felt inconsistencies between explicit goals and implicit motives may even lead to a drop-out of professional tennis.

Another thought must be spent on the social acceptance of the power motive in Germany. Although the athletes in study three are from many different nations German sportsmen are over-represented in the sample. From the descriptive statistics we can see that the explicit power motive is the least pronounced in the sample. This might be because the power motive is in society the least accepted one to be explicitly uttered. Since studies often report negative effects of incongruent achievement or affiliation motives as power motives there may be a different problem.

Achievement vs. Power Theme. The explicit achievement motive is negatively associated with match and tie-break performance over the past four years in racquet sports. Furthermore, the implicit achievement motive is positively related to performance in unconscious critical situations. Additional assessment of the implicit power motive allowed prediction of the career high by the amount of practice hours in racquet sports. Moreover, the congruence measure of the power motive is negatively correlated with career performance like the maximum and present amount of practice hours, match and tie-break performances over the past four years as well as self-reported measures of dominant play.

All associations with performance and the explicit motives are limited to the achievement motive. For Jackson (1999), an achievement-motivated person tries to “accomplish difficult tasks, is willing to work toward distant goals, and responds positively to competition” (p. 5). A power-motivated individual tries to “control or influence his or her environment or other people” (p. 6). Clearly, the definition of the explicit achievement motive can be much better associated with a competitive sports context. The definition of the explicit power motive is socially not accepted. However, in the factor analysis in study three the explicit power motive was associated with the achievement motive. Yet, more variance could be explained by the achievement motive for variables like amount of practice hours, performance in matches and tie breaks over the past four years as well as in critical situations.

Study three is one of the first studies in sport psychology to investigate the differential validity of the explicit and implicit power motive in sport. Although for the explicit power motive no associations with athletic behavior were found, the implicit power motive seems to be a valuable predictor for performance in racquet sports. This is in line with for example Kuhl and Krug (2006) who claim that in interacting sports in which two athletes compete against each other (e.g., racquet sports, martial arts) elite athletes show heightened levels of the implicit power motive. Results from study three suggest that a high implicit power motive seems to be useful for winning matches and practicing more in these kinds of sports. Since the power motive is concerned with having physical, mental, or emotional impact on others (Brunstein, 2008; Veroff & Veroff, 1972; D. G. Winter, 1973) winning real competitions in sports is an easy way to experience impact and control over others. In this way results from study three confirm expectations of the value of the power motive. For future studies in these kinds of sports, researchers might consider measuring the power in addition to the achievement motive if they desire to predict sports performance. Including the power motive additionally

allowed strong predictions on practice behavior, match and tie-break performance, and self-reports on dominant play from the perspective of motive incongruence.

Nevertheless, the achievement motive seems to be associated with higher performance in unconsciously critical situations. There are hints to why the achievement motive is associated with performances in unconsciously critical situations but not with tie-break performances. The heart of the achievement motive, according to McClelland (McClelland, et al., 1953) is improving skills and seeking success in challenging tasks. In contrast, the power motive is concerned with having impact (Veroff & Veroff, 1972; D. G. Winter, 1973). In the present data it could be seen that the implicit power motive is positively associated with performance in tie breaks while the implicit achievement motive is related to performance in unconsciously critical situations. This may seem like a contradiction. However, tie breaks can be lost or won always at the end of a set, in other words, they can be assumed to be consciously critical. Thus, the power motive should be much more stimulated by the *performance goal* of winning a tie break. In contrast, unconsciously critical situations are distributed all over a set with no real end point. In these situations, it can be assumed that the implicit achievement motive may be much more predictive for these *mastery goals*. Furthermore, results on performance in service games as well as on rally length support findings for the power motive. The power motive, namely, shows a correlation with affect regulation (see Table 4.2). That means athletes who are highly able to recover from negative emotional experiences are rather power-motivated. Since power-motivated individuals are more concerned with how they may be effective in the future than worrying about the past this correlation is comprehensible. Now, high affect regulators win more points in service games (Table 4.21) and play generally shorter rallies (Table 4.18) they seek decision in a rally as quickly as possible. This *performance goal* of finishing a rally in order to score a point can be aligned with typical behavior of power-motivated individuals. Last but not least, affect regulation is particularly associated with the power motive (see Table 4.2).

Specificity of Racquet vs. Team Sports. In racquet sports, explicit motivational and regulatory processes determine long-term competitive performance such as in matches and tie breaks over the past four years as well as performance in critical game situations. In basketball, only implicit processes of affect regulation are predictive for shooting performance over a whole season or free-throw and defensive rebound performance within close games.

When examining the impact of implicit vs. explicit information processes on athletic behavior it must be carefully determined what kind of behavior should be predicted. Findings in racquet sports like tennis, table tennis, and badminton rather point in the direction of explicit processing; not only for competitive performance as a whole but also in critical situations. Primarily, a low explicit achievement motive, the inhibition of conscious self-regulation (study three), and low affect regulation (state-orientation, study one) seem to determine performance. As mentioned above, tennis is a less arousing sport compared to basketball (Landers & Arent, 2006). For example, in tennis only 20% of the total match time is spent playing the ball; the rest of the game is determined by breaks. Because of these low to medium arousal levels in tennis explicit information processes can exert their influence unhindered (Metcalf & Mischel, 1999). Similar results are suggested by Roth and Strang (1994), who found that low affect regulators make higher quality decisions as long as they are under no time pressure and no physical stress,. Thus, in racquet sports, most of the time no obvious need to switch over to more implicit forms of information processing.

In contrast, study two clearly points to an advantage of implicit forms of affect regulation in basketball. This is a common finding for a team sport like basketball (Beckmann & Kazén, 1994; Heckhausen & Strang, 1988). Moreover, due to the structure of the game implicit processing seems to be a reasonable way of information processing. Particularly in basketball there is usually no time for deliberate thinking in between the actions. Highly intensive seconds of an offensive play are immediately

followed by highly intensive actions in the defensive. Moreover, only 24 seconds are available for an offensive play, 8 seconds are given to carry the ball out of the own half, and after 5 seconds the ball has to be shot, passed, or dribbled. Furthermore, there are 10 players on a small field in between which a basketball player needs to position himself. This makes playing basketball a highly complex, temporally stressing sport in which physical stress is at between 70-90% of maximum heart rate. It is thus to be expected that implicit information processes have a much greater effect on performance than explicit ones (Metcalf & Mischel, 1999). Other researchers also found that performance impairments under stress are less often found in high affect regulators (Heckhausen & Strang, 1988) because they have a faster recovery after stress (Beckmann & Kellmann, 2004). Additionally, Beckmann and Kazén (Beckmann & Kazén, 1994) showed that high affect regulators (implicit processing) should have an advantage in highly complex sports because of more efficient energy regulation as well as better tactical decisions. Only free throw breaks offer the opportunity to think about different aspects of the game. In tennis, table tennis, and badminton, in contrast, athletes have a certain time span after each rally in which they can determine the speed of the game and decide whether they need further planning, deliberate thinking or to keep on playing. This is a difference compared to the information processing conditions of a continuous team sport like basketball or soccer.

Besides differences between certain kinds of sports there are several authors who point to different demands on position within one and the same sport. In study two, for example, it could be shown that guards are much more explicit processors compared to centers (cf. Beckmann & Kazén, 1994). These differences could also be shown between midfielders and strikers in soccer (Roth & Strang, 1994). The functional reason for this difference is explained by different tasks a guard has to fulfill compared to a center. A guard needs to perceive different options and thus needs a broad perspective on the game in order to play a good pass. In contrast, a center

needs a narrow focus in order to not be distracted from scoring a basket. These differences in demands depending on the position in high performance team sports are due to a strict division of work between the different playing positions.

Toward a Model of Implicit and Explicit Motivational Processes in Sports

Summarizing the findings of the three studies reported a model of implicit and explicit motivational processes for high performance athletes is proposed (see Figure 5.1). This model is a first attempt to sensitize the field of sport psychology for the discriminant validity of implicit and explicit motivational processes in sports. It is a first proposal of a model in need of extension, adaption, and modification. For now, this model is based on research primarily conducted within racquet sports. Further research may extend the model based on different instruments and findings in different kinds of sports.

Basic properties of implicit and explicit motivational processes are adopted from dual-process theories (Strack & Deutsch, 2004) and respective motivational theories on implicit and explicit motives (McClelland, et al., 1989; Schultheiss, 2001) and the impact of affect regulation on the activation of implicit and explicit cognitive systems (J. Kuhl, 2000a). Within the narrow frame of task specificity the link between perception and behavior is either directly determined by implicit processes or when possible guided by explicit information processing. However, this detour through sequential, explicit processing is time consuming. When arousal levels are high explicit processes will no longer determine behavior and implicit processes will take over (Metcalf & Mischel, 1999). On a very general level, the kind of sport in question could offer a framework that limits either system in its effectiveness. For example, arousal levels in tennis are lower than arousal levels in basketball (Landers & Arent, 2006). Similarly, in basketball, guards need a broader attentional focus than centers (Beckmann & Kazén,

1994). Since implicit motives are associative networks that cannot be easily changed repeated and long-term athletic behavior like practice hours and competitive performance should be predicted by implicit motives unless task specificity leads to different demands. In complex, highly arousing, unconsciously negative affect provoking situations with time restraints implicit motives should direct behavior. This is the case, especially, when there is limited chance of awareness for the effects of time restraints, complexity, and negative affect. In contrast, when like in tennis time constraints are smaller and physical stress is lower performance may be guided by explicit processes.

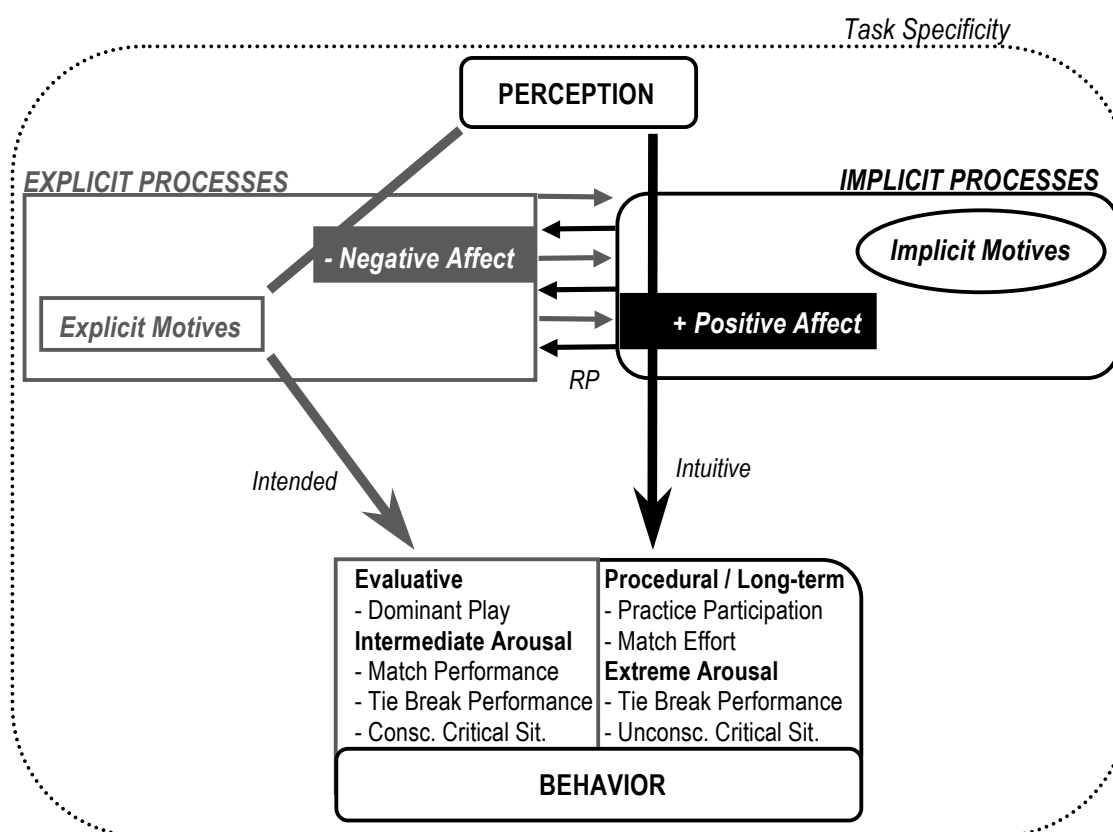


Figure 5.1 Model of the predictive value of implicit and explicit motivational processes in racquet sports (in dependence on Strack & Deutsch, 2004; Kuhl, 2000; Schultheiss, 2001)

For explicit motivational processes, the model proposed suggests predictive value especially for performance in matches and match situations that are not highly

arousing or consciously critical. Because of only 20% playing time, the game of tennis is intermediately arousing compared to other sports (like basketball). There are many opportunities throughout a match to deliberately reconsider match plans and consciously cope with high stress levels. Furthermore, in major league racquet sports athletes usually play a certain position according to their ability. This position is carefully chosen by the coach in order to increase the probability of winning a match for the team. This also contributes to the assumptions that racquet sportsmen perform at intermediate arousal levels. In addition, explicit motivational processes are assumed to have impact on evaluations athletes carry out concerning their performance. Among such are self-evaluations about how dominantly they have played in a match.

Limitations

The three studies that were carried out within the work at hand are subject to several limitations. These limitations concern the fact that all three studies conducted are field studies. Moreover, the indirect measure of implicit motives used in study three must be evaluated carefully. Additionally, results of the three studies should not simply be generalized to other kinds of sports.

Internal Validity. All three studies conducted within the present work are field studies and employ a quasi-experimental design. This was done in order to take experimental control to its reasonable limits (Tuckman, 1999). Research on the topic often produced inconsistent findings when laboratory results are applied to real sports settings (cf. the concept of intrinsic motivation in elite sport; Chantal, et al., 1996). Thus some sources of variance could not be controlled in the present studies. In tennis for example players performed on outside clay courts, so external factors like the court, wind, humidity, temperature etc. had impact on the players' performance. In all sports spectators, coaches, opponents, and referees were present and exerted influence on

the outcome of the games and an individual athlete's performance. However, the attempt of the present research is to apply theoretical concepts of dual processes to real sport situations and is thus exploratory in nature. The author's intention was to give access to a new research field for motivational psychology in sport. It was attempted to use the concept of implicit motives and the dissociation between explicit and implicit motives for a more complete understanding of how psychological variables are associated with phenomena in sports. Nevertheless, for future research the challenge is to isolate single skills and control for biases in experimental settings, yet still try to discriminate the concepts of implicit vs. explicit motivational processes.

Exploration of Dual Processes in Sports. Because of the exploratory character of the present studies attention is not only paid to results of inferential statistics like regression analyses or analyses of variance but also to single correlations and descriptive statistics included in this work. To this end, pointing to significance values of 10% ($p < .10$) may sometimes help to get the big picture of the multitude of results included. However, correlations and descriptive statistics should not be interpreted outside their context and not be extracted from the lines of arguments presented. Never should they be interpreted causally.

External Validity and Generalization. Of course the fact that the three studies reported here are all field studies offers a great deal of external validity for real sports situations. However, even within the three racquet sports (tennis, table tennis, badminton) included in the present studies there is a great deal of structural difference. This difference in task specificity may result in different psychological demands of these sports. Only one team sport was included in the present research – basketball. Results suggest that implicit processes are of higher predictive value for basketball than for racquet sports. Yet in contrast to racquet sports, no replication of findings is achieved within the present work. Thus, the model of implicit and explicit processes proposed in

this work should be limited to racquet sports. In order to generalize findings to other team sports, further research is needed.

Projective Measures. Within study three the Operant Multi-Motive Test (OMT; J. Kuhl & Scheffer, 1999) is used to assess implicit motives of achievement, affiliation, and power. In comparison to the TAT (Murray, 1943) the format of the OMT is supposed to be more convenient for participants because no complete stories or whole sentences need to be written. Furthermore, the OMT uses five pictures per motive in order to gain higher internal consistencies. However, in the research presented here internal consistencies are comparable to low consistencies in TAT measures. Retest reliability for indirect motive measures usually depends on the retest interval (Schultheiss & Pang, 2007). Since the OMT is a relatively new measure for implicit motives no further studies are available. Although inter-rater agreement of trained coders in study three is satisfying the OMT lacks normed practice sets. Additionally, because of the newness of the instrument, the OMT scoring set is still under modification (Scheffer, 2001). Although not reported by the sample from study three, other researchers report that participants in different sports samples argue about the pictures presented. More sports-related pictures may enhance acceptance of an indirect measure for athletic samples.

Discrimination of Motivational and Regulatory Themes. Finally, because of the multitude of psychological variables included in study three a factor analysis was conducted. Although, this data reduction technique allowed for inferential statistics to be calculated the interpretation of results is sometimes difficult. For example, the respective predictive value of the motivational themes of achievement and power may only be differentiated by descriptive statistics. This is especially problematic because the implicit motives of achievement and power are negatively correlated. Explicit motives as well as affect and self-regulation abilities are positively associated.

Future Directions

The discrimination of implicit and explicit motives within one study is a relatively new topic in the field of sport science and sport psychology. As described in the work above this topic offers new, interesting questions which may shed new light on the link between motivation and athletic performance. In the present work only field studies are included. However, for in depth research on the dissociation of the two information processing systems further experimental research is needed in order to “dissect” single effects included in the present research. Some directions for future research that result from this new approach are listed below.

Unconscious vs. Conscious Stimuli and Respective Information Processes. One area for further research could be the discrimination between nonverbal (unconscious) and verbal (conscious) cues as stimuli for the respective motivational system. As could be seen in the present research, different motivational systems guide behavior depending on the format of the cues experienced. When critical situations are consciously present and may be verbalized, the explicit motive system primarily predicts behavior. Such effects could be tested in laboratory settings, in which controlled stimuli are presented either subliminally or supraliminally. These stimuli could for example trigger negative or positive affects. The effects of supra- and subliminal presentation of affective primes could be assessed by direct or indirect affect measures (Quirin, Kazén, & Kuhl, 2009; Watson, et al., 1988). Moreover, in future research these measures could be used to assess affect regulation ability directly as well as indirectly, independent of the more general questionnaire ACS.

Explicit vs. Implicit Processes in Dependence on Arousal Intensity. Within the present work it is concluded that the level of arousal a certain kind of sport exerts on the athlete has an influence on what motivational system guides behavior. If arousal levels are very high implicit forms of information processing influence behavior. At low

to intermediate levels of arousal the explicit motivational system may still work unimpaired. This hypothesis may easily be tested using a standardized shooting experiment (like a basketball free throw) and test motivation-performance links at different levels of physical activity. Furthermore, it could be of interest how mental stress could be gradually increased or controlled in experimental settings. This way, the effects of physical and mental arousal could be dissociated.

Neurophysiological Mechanisms. In order to control the effects of physical and mental arousal physiological parameters like heart rate deceleration (Carlstedt, 2004a) should be assessed and could be accompanied by neuroendocrinological markers like cortisol and testosterone (Budde, Pietrassyk-Kendziorra, Bohm, & Voelcker-Rehage, 2010). Moreover, implicit motives (Hall, Stanton, & Schultheiss, 2010) and implicit affects (Quirin, Kazén, Rohrman, et al., 2009) are clearly linked to respective endocrinological parameters. Thus, in future research on implicit affect-based measures, endocrinological parameters should accompany questionnaires. Given some of the problems concerning psychometric properties of indirect measures relying more on endocrinological measures could be considered in predicting athletic behavior. However, for the achievement motive there is still need for further research on physiological correlates (cf. Schultheiss, 2008).

Motive Themes and Interactive vs. Individual Tasks. In the present research, assessing the power theme in addition to the achievement motive significantly increased prediction of long-term athletic behavior. Insofar, further studies could investigate whether the power motive better predicts performance in interactive sports while the achievement motive rather influences behavior in individual sports (U. Kuhl & Krug, 2006). However, the power theme has not been investigated in sport psychology from a perspective of the dissociation of implicit vs. explicit information processes. Additionally, research in the affiliation motive in sport psychology is almost as scarce (Teubel, 2011). As can be seen from the present research, investigating the discriminant validity

of different motivational themes (like the power motive) may result in findings that challenge present theoretical assumptions. Further elaboration is needed here.

Practical Implications. Finally, future research may focus on practical implications of the dissociation between implicit and explicit motivational processes for sports performance. Other authors for example suggest that athletes may purposefully activate a respective brain hemisphere before executing a certain movement or skill in order to improve performance (Carlstedt, 2004a). Respective brain activation may be realized through gaze manipulation or tactile activation. Practical psychologists among others suggest that athletes should look to the right before serving in order to activate the left brain hemisphere. Others suggest squeezing a tennis ball with the respective hand in order to activate left or right brain regions. Future research may test these hypotheses in controlled laboratory settings.

AFFIRMATION

I hereby affirm that I wrote the present work unaffiliated. All references and additional resources are tabulated in the respective lists. All contextual and direct quotes from other works are marked. Except for the ones enumerated, no further resources or aids were used.

Berlin, December, 6th 2011

ERKLÄRUNG

Hiermit erkläre ich, dass ich die vorliegende Arbeit selbstständig verfasst habe. Alle Textstellen, die dem Wortlaut nach oder sinngemäß anderen Werken entnommen sind, wurden unter Angabe der Quellen gekennzeichnet. Die verwendeten Quellen und Hilfsmittel sind in den entsprechenden Verzeichnissen aufgelistet. Außer den genannten wurden keine Hilfsmittel verwendet.

Berlin, den 6. Dezember 2011

Mirko Wegner

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